# PUBLIC HEALTH REPORTS

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Public Health Service

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# PUBLIC HEALTH REPORTS

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## frontispiece . . .

The new Tuberculosis Infirmary for Negroes at Sanatorium, Miss., represents an important forward step in the State's effort to control and eventually wipe out tuberculosis. It adds 154 beds in a thoroughly modern plant (top right) built with the aid of Federal funds under the State plan which is a prerequisite to participation in the Hospital Survey and Construction Program.

Among new adjunct facilities designed to help attract and keep good personnel are the nurses' home (center), the duplex houses for staff (lower right), and a dormitory for maintenance workers.

Since housekeeping, administrative, and maintenance operations were already provided for in older buildings, space in the new main building is devoted almost exclusively to patient care facilities. Perhaps the most striking feature from the clinical standpoint is the eight-bed postoperative unit which occupies a wing on the second floor. It is a self-contained nursing unit equipped to give the specialized nursing care indicated immediately following a major operation.

The layout of the building shows facilities which are used jointly for in- and out-patients and are located conveniently to both types of patients. Numerous aids to patient comfort and rehabilitation are provided, including an occupational therapy and recreation department well above the average. (R. W. Naef, West Jackson, Miss., was the architect.)

## *Contents for July, continued*

# PUBLIC HEALTH REPORTS




U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OVETA CULP HOBBY, *Secretary*

PUBLIC HEALTH SERVICE
LEONARD A. SCHEELE, *Surgeon General*

# Tuberculosis Cases Known To Health Departments

By ROBERT J. ANDERSON, M.D., HERBERT I. SAUER, and ROGER L. ROBERTSON, M.A.

HOW MANY tuberculosis cases are known to health departments in the United States? Are they receiving needed public health supervision; that is, are they receiving periodic medical examinations, laboratory services, and the instruction necessary to prevent further spread of tuberculosis?

Ideally, one of the best measures of the tuberculosis problem in the United States lies in true prevalence, that is, the total number of cases at a given time. For it is these cases which, in the aggregate, represent the actual and potential reservoir of infection and which require case-finding facilities, public health supervision, and medical care in order to prevent or alleviate disability and economic loss from the disease.

In the absence of data on true prevalence, public health workers have for many years attempted to measure the size of the tuberculosis problem and the progress made against it in terms of mortality—the number of tuberculosis deaths occurring annually. Declining tuberculosis mortality rates, however, are probably a poor index of changes in prevalence, since they partially reflect declining case fatality rates resulting from earlier and more effective case finding and treatment. Declining case fatality rates and a continuing high level of morbidity reporting tend, in turn, to maintain known prevalence at a high level, since cases of a type which previously terminated in early death now go on, after an extended period of treatment, to an arrested state. These cases, with the ever present opportunity for reactivation, are thus actually present in our population for longer periods than previously.

The true prevalence of tuberculosis can only be estimated. Until recent years, there have been very few counts of the number of known cases, even for large local health departments. Now, with increased use of tuberculosis case registers in various parts of the country, more information is becoming available regarding known cases and their supervision.

In the past, most data on tuberculosis morbidity have been on cases newly reported during a given year. This present study, however, deals with known prevalence—the total number of known tuberculosis cases as of a specified date—and with the public health supervision of those cases. By definition, known prevalence includes all cases which are considered by the health department at the date of tabulation to be significant for supervision, even though these cases may have been first reported as new cases many years previously. This includes not only active tuberculosis cases but also those with activity undetermined, arrested tuberculosis, or inactive tuberculosis which the health department considers significant for supervision. Known prevalence should not be confused with true prevalence, since the latter includes also estimates of the number of unknown cases in a specified area.

*Dr. Anderson is chief of the Division of Chronic Disease and Tuberculosis, Public Health Service. Mr. Sauer and Mr. Robertson are statisticians in the division.*

Recent estimates of prevalence which have appeared elsewhere have been based in part on the preliminary summaries of data presented in this report (*1, 2*).

### Sources of Data

Reports used in this study bear various dates between January 1949 and January 1953. Included are reports from 19 entire States (except for 4 local health departments whose reports are tabulated separately because their tuberculosis control programs are administratively separate from the States'), districts in 2 States consisting of a number of counties in each, and 47 local health departments. Thus there is included a total of 72 areas presenting data on one or more aspects of the problem here discussed. These areas account for approximately 50 percent of all tuberculosis deaths and 46 percent of the total population in the United States. In all, 38 States and the District of Columbia are included either wholly or in part.

Statistical reports from a specific administrative level (State, district, or local) were included in this study only when there was known to be a definite policy and practice at that level of obtaining information on the supervision of cases and their current status. Generally, the reports used were prepared on the tuberculosis case register summary report, for the most part in accordance with recommended instructions (*3*). However, since these reports were prepared by individuals in many different health departments, there were undoubtedly some variations in the procedures used. In summarizing these reports, every attempt has been made to include from each only those data which were reported in accordance with accepted practice or which could be made comparable by a minimum of editing. It is for this reason that there is variation in the number of areas reporting each type of information tabulated.

Of the 72 areas for which data were available, 22 are places in which communitywide chest X-ray surveys have been conducted in cooperation with the Public Health Service. While the remaining 50 areas have had some X-ray case-finding activities, the proportions of the populations X-rayed have generally been much smaller. Comparisons between the areas with more intensive case finding and areas with less intensive case finding are presented throughout this paper. It seems likely that the differences noted reflect the effects of the X-ray surveys and the intensification of tuberculosis control efforts resulting therefrom. However, there is no absolute assurance of this, since the surveyed areas are not statistically representative of all areas for which data are available. Nevertheless, certain comparisons may be made which appear meaningful. For example, comparisons of known prevalence rates in surveyed areas with those in nonsurveyed areas probably are sound enough to permit some conclusions as to the effects of communitywide surveys.

### Known Prevalence

In the 72 areas included in this study, there were 233,028 tuberculosis cases known to health departments and considered by the health departments to be significant for supervision, a rate of 339 known significant cases per 100,000 population (table 1). As is also indicated in

**Table 1. Known tuberculosis cases and case rates in selected groups of health department areas**

[United States, January 1949 through January 1953]

| | Number of health department areas with data available | Population included in group of areas (as of Apr. 1, 1950) | Cases | Cases per 100,000 population |
|---|---|---|---|---|
| Total known cases | 72 | 68,762,021 | 233,028 | 339 |
| Survey areas | 22 | 12,239,785 | 57,973 | 474 |
| Other areas | 50 | 56,522,236 | 175,055 | 310 |
| Active cases | 56 | 45,343,259 | 72,185 | 159 |
| Survey areas | 22 | 12,239,785 | 21,725 | 178 |
| Other areas | 34 | 33,103,474 | 50,460 | 152 |
| Positive sputum cases at home | 49 | 45,504,340 | 11,760 | 26 |
| Survey areas | 16 | 7,232,554 | 2,569 | 36 |
| Other areas | 33 | 38,271,786 | 9,191 | 24 |
| Hospitalized cases plus positive sputum cases at home | 47 | 42,929,325 | 36,773 | 86 |
| Survey areas | 16 | 7,232,554 | 8,677 | 120 |
| Other areas | 31 | 35,696,771 | 28,096 | 79 |

table 1, the areas which have had community-wide chest X-ray surveys had much higher rates of known significant tuberculosis (474 per 100,000 population) than did other areas (310 per 100,000 population). For individual areas the rates ranged from 50 to 1,800 cases per 100,000 population.

Aside from the true prevalence of tuberculosis in each area, factors which appear to influence the number of known significant cases are: (*a*) the extent and effectiveness of case finding and reporting, (*b*) the extent of efforts to maintain supervision of known significant cases, and (*c*) the promptness with which cases are dismissed. Some health departments, for example, dismiss a case merely because it is reported as lost, while others make a thorough search for the patient before discharging him as lost. Some health departments, too, find it administratively desirable to dismiss cases from the central register as soon as they are classified as inactive, while others may continue supervision until the cases have been arrested or inactive for 5 years.

### Active Cases and Hospitalization

In 56 areas with information available regarding activity status, there were 72,185 active tuberculosis cases known to health authorities, or approximately 159 per 100,000 population. Among these areas there was a range from 30 to 1,227 known active cases per 100,000 population (fig. 1). Variations in these rates no doubt parallel variation in the true prevalence of tuberculosis more closely than do the rates for total cases known, since health department policies for keeping active cases in their case registers are more nearly uniform than those governing total significant cases (which include arrested cases).

Known prevalence of active tuberculosis is also influenced, however, by the extent and effectiveness of case finding and case holding. This is suggested by the fact that those areas which have had communitywide chest X-ray surveys showed 178 known active cases per 100,000 population, in comparison with a rate of 152 in the nonsurvey areas. Before the surveys, survey areas had rates similar to those of nonsurvey areas.

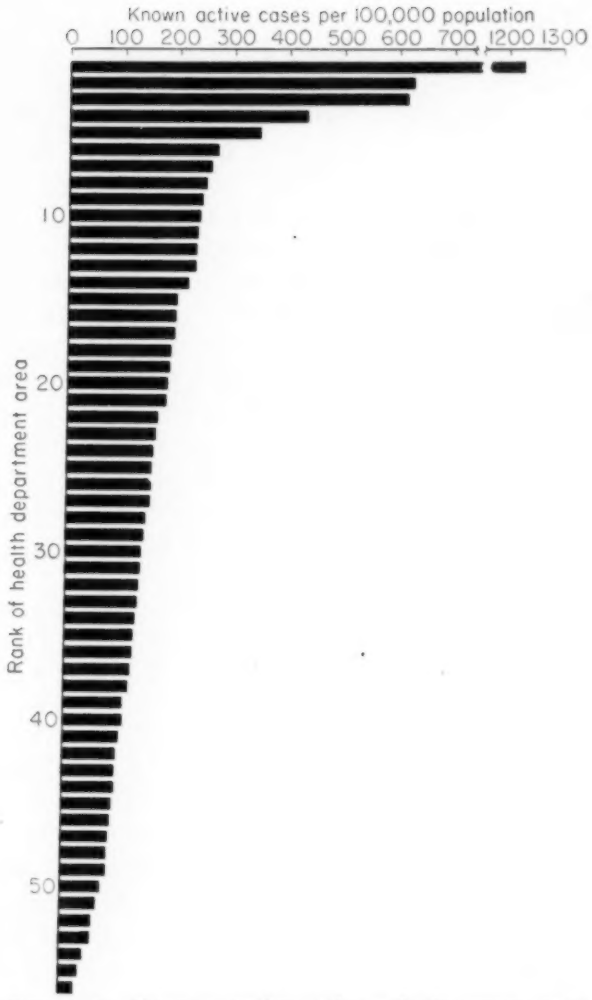


**Figure 1. Known active tuberculosis cases per 100,000 population, 56 health department areas in the United States.**

Cases were diagnosed as active with varying amounts of clinical proof. Those with positive sputum and those hospitalized for tuberculosis may be said to have the most clearcut evidence of active tuberculosis, and thus as a group may be said to be the more serious cases. In these terms, again the areas which have had communitywide surveys had higher rates than did the other areas: The cases hospitalized for tuberculosis plus the positive sputum cases at home amounted to 120 per 100,000 population in the group of survey areas, as compared with only 79 per 100,000 in the other areas (table 1).

Approximately 46 percent of the known active cases in the areas studied were hospitalized. In the area most acutely in need of more beds, only 20 percent of the known active cases

were hospitalized, while in the areas with sufficient numbers of beds, about 80 percent were hospitalized. One large area which was endeavoring to hospitalize all those needing such care had 74 percent of its known active cases hospitalized and still had a short waiting list. These and other data indicate that of the known active cases in a community, approximately three-fourths need and will accept hospitalization, and one-fourth will not be hospitalized at a specific time. This latter group of known active cases will include the few who are unwilling to be hospitalized or who have adequate care at home, those awaiting hospitalization, and those who have been hospitalized previously but whose disease has not yet been arrested. Since cases usually are known to health authorities before they are hospitalized, more complete information on numbers of known active cases may provide a means of indicating hospital bed needs for tuberculosis.

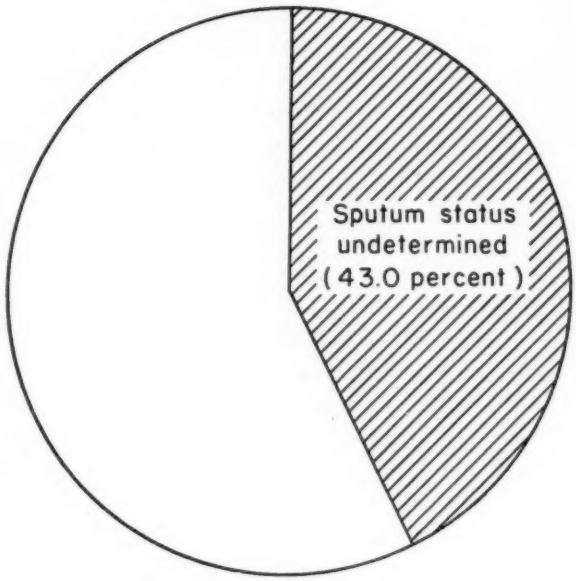


**Figure 2. Sputum examination status of active and activity undetermined cases of tuberculosis at home.**

### Positive Sputum Cases at Home

From the public health point of view, the cases usually considered most important are the positive sputum cases at home. These are the cases which have been definitely proved to be infectious and which, because they are at home, are in a position to spread tuberculosis to family and community. Information was available from 49 areas on the number of cases at home with positive sputum or other demonstrations of tubercle bacilli. In these areas, 11,760 such cases were known (table 1)—a rate of 26 per 100,000 population. In the surveyed areas, there were 36 cases per 100,000 population as compared with 24 per 100,000 in the other areas. In other words, in the areas with more intensive X-ray case finding, there were more cases at home known to have positive sputum, as well as more cases hospitalized.

### Supervision of Cases

How effectively are known tuberculosis cases supervised? How frequently are they ignored as if they were unknown? The effectiveness of health department efforts to determine the sputum status of their known cases is shown in figure 2. Of 34,836 active and activity undetermined cases at home in 36 areas with appropriate data available, 14,965, or 43 percent, were of undetermined sputum status. Communitywide chest X-ray surveys have been conducted in 14 of these areas, and reports reveal less than one-third of the active and activity undetermined cases at home with unknown sputum status, as compared to almost half in other areas.

Health departments generally have the policy of obtaining periodic reports regarding the supervision of significant cases in the tuberculosis case register. Another index of the effectiveness of supervision is the proportion of unhospitalized cases in the register for which the health department has had no examination report within the past 12 months. Although such information was available from only 28 of the areas included in this study, the data are nevertheless suggestive. A total of 47,110 tuberculosis cases at home were classified by examination status, and it was found that 15,815 of those cases, or 33.6 percent (fig. 3) had had no X-ray or clinical examination report within the preceding 12 months. While some of these patients may have been more recently examined, the health department had no information to show that they were receiving either medical or public health supervision.

Communitywide surveys had been conducted in 13 of these areas. For these 13 areas as a

group, 27 percent of the significant cases at home had not had an examination report within the preceding 12 months, as compared with 42 percent for the other areas. Only one community-wide survey area reported a higher than average percentage of cases without an examination report during the preceding year.

Often a distinction is made between the unknown cases in a community constituting sources of infection, and the known cases presumed to be under control and therefore not sources of infection. However, it is clear that there are still large numbers of known tuberculosis cases which, according to health department records, are not being supervised and are probably receiving little more attention from the health departments than are the unknown cases.

In a few areas, data on examination status of patients at home have been tabulated separately for the active cases on the one hand, and for the arrested and inactive cases on the other. It is rather surprising that the active cases at home in these areas show just as high a proportion of cases not recently examined as do the arrested and inactive cases. Since the supervision of active cases at home is generally believed to be far more important than that of the arrested cases, it would appear especially desirable to intensify efforts to obtain examination reports on known active cases.

### Estimated Known Prevalence

As indicated earlier, data presented in the foregoing analysis apply only to those areas for which information was available for the 1949 to 1953 period. While these areas represent almost half of the population of the continental United States, they were selected on the basis of the reports available and therefore are not necessarily a random sample. Yet, to a considerable extent, these areas can be tested for representativeness on the following bases: (*a*) the racial distribution of the population; (*b*) the geographic distribution of the areas included; (*c*) the inclusion of areas both with organized local health units and those without; (*d*) the inclusion of both State and locally directed programs; (*e*) the adequacy of the tuberculosis control programs in the various areas included, as measured by various indexes, together with data obtained in the course of field consultation; (*f*) the tuberculosis death rate; (*g*) the inclusion of areas which have recently had intensive X-ray case-finding surveys; and (*h*) the inclusion of populations in mental and penal institutions.

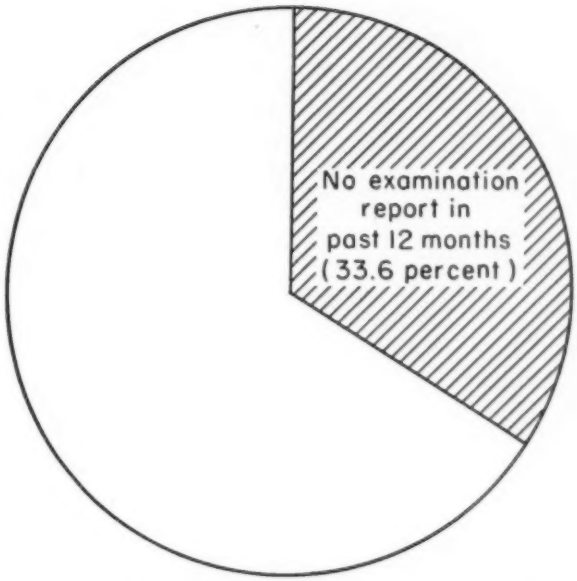


**Figure 3. Recentness of medical examination report on known significant tuberculosis cases at home.**

In each except the last three of these respects, the group of areas considered in the present study appears to be fairly representative of the continental United States. It was noted, however, that the areas as a group differ from the remainder of the United States in that they had a slightly higher tuberculosis death rate, a disproportionately large number of areas which have had communitywide X-ray surveys, and underrepresentation of the populations of mental and penal institutions. Careful attention has been given to the weighting of each of these three factors in estimating the prevalence of known tuberculosis cases in the continental United States.

By projecting the data contained in table 1, we can arrive at estimates of known tuberculosis prevalence in the continental United States, as follows:

| | |
|---|---|
| Total known significant cases | 450,000 to 500,000 |
| Known active cases | 225,000 to 250,000 |
| Known positive sputum cases at home | 35,000 to 40,000 |

These national estimates are probably the best informed guesses as to the size of the tuberculosis problem known to health departments throughout the country. As case reporting and supervision further improve, and as reports from health departments become more generally available, this type of data will become increasingly more meaningful as an index of our tuberculosis control problem.


### Summary

1. Tuberculosis case register reports for areas comprising nearly half the population of the continental United States are analyzed.

2. In the areas studied, there was an average of 339 known significant tuberculosis cases and 159 known active cases per 100,000 population.

3. In 43 percent of the cases at home classified as active or activity undetermined, sputum status was unknown to the health departments reporting.

4. About one-third of the known significant cases at home had not had an X-ray or clinical examination within the preceding 12-month period, according to the health department records studied.

5. In the areas which have had community-wide chest X-ray surveys, prevalence rates for known significant cases and for known active cases were substantially higher than in other areas. The communitywide survey areas had examined the sputa of a higher proportion of their patients and had maintained followup information more satisfactorily than had the nonsurvey areas.

6. It is estimated that there are almost 500,000 known significant tuberculosis cases in the continental United States, and that nearly 250,000 of them are active. Approximately 40,000 of these are known positive sputum cases at home, and there is an additional large number at home whose sputum status is undetermined.

7. In spite of the rapid decline in tuberculosis mortality, it is apparent that the disease remains a problem of very serious dimensions.

8. In view of the large proportion of cases for which both sputum status information and recent examination reports are lacking, it is apparent that the public health supervision of individual tuberculosis patients is inadequate in many areas.


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(2) Prevalence of tuberculosis in the United States. Pub. Health Rep. **67**: 766 (1952).

(3) Enterline, P. E., and Sauer, H. I.: Community-wide chest X-ray survey. VI. Records and reports. Pub. Health Rep. **66**: 1622–1624 (1951).


## Correction

In the table, "Thirty-one community-wide X-ray surveys, 1945–53," p. 548, May issue, the figure in the last column for Milwaukee, Wis., should read 557.

# Twenty-six Years of Cancer Control In Massachusetts

By HERBERT L. LOMBARD, M.D., M.P.H.

MORE THAN a quarter century of experience in cancer control is on the records of the Massachusetts Department of Public Health. With no precedent to follow, with no knowledge of the public health aspects of the disease, without even a clearcut idea that cancer was a public health problem, the State health department launched a cancer control program May 29, 1926.

At the 52d annual meeting of the American Public Health Association, Dr. Eugene R. Kelley, Massachusetts commissioner of public health, pointed out the need for: (*a*) determination by health department administrators of their proper niche in cancer control; (*b*) better statistical data on cancer facts and additional personnel and funds to enable health administrators to collect, collate, analyze, and diffuse these facts; (*c*) extended facilities for early diagnosis and stimulation of the professions to use these facilities fully; (*d*) better hospital facilities for the inoperable group of cancer patients; (*e*) new and efficient methods of arousing and retaining public interest in and understanding of the significance of cancer "whereby a large degree of success may be reasonably anticipated even with our present faulty weapons for combating the menace of malignancy."

Today about two-thirds of the States have some State-supported service or facility specifically for cancer patients (*1*). But the requirements of cancer programs discussed by the commissioner of public health of Massachusetts in 1923 are still not met.

The component parts of a cancer program are varied, and there is a tendency toward selection of program activity by different units of the population. Physicians often limit the scope of activity to the care and treatment of cancer; sociologists interest themselves in problems connected with the inadequacy of services for those in the lower economic levels of society; individuals interested in research consider this

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Recognition of cancer as a public health problem has led to the development of control programs in all of the States, and in the Territories and insular possessions of the United States. Some of these programs are relatively long established and have evolved not only valuable epidemiological data, but important techniques for coping with cancer as a disease of public health importance.

Effective cancer control programs are distinguished by certain policies and practices uniform to all, and by provisions for meeting the special requirements of the particular area concerned. Such a program is that of the Massachusetts Department of Public Health, described in the accompanying article. *Public Health Reports* from time to time hopes to present reviews of other cancer control programs. That of the New York State Health Department was described in our December 1952 issue.

—THE EDITORS.

the all-important field; women's organizations interest themselves in education; statisticians tend to worry over death rates, age distributions, and the like, often forgetting other factors in the cancer problem; and public health workers think of the application of public health methods to cancer control.

The Massachusetts program, consisting of research, hospitalization, diagnostic clinics, tumor diagnosis service, and education, is based on the accumulation of experience gained largely through trial and error. Since Massachusetts was compelled to pioneer, all procedures have been subjected to evaluation in order to gauge their effectiveness.

### Statistical Research

The statistical approach is fundamental in a public health program. From statistical studies, the Massachusetts cancer program received its inspiration, determined its scope, evaluated its activities, changed its policies, and obtained new ideas for cancer control.

Our data for research and evaluation, as well as for statistical enumeration, are obtained from the death records, hospital records, clinic records, questionnaires to physicians, records of contacts with individuals concerned in the educational program, followup records, and personal interviews in house-to-house surveys. This material is transferred to punchcards, tabulated, and analyzed.

The findings of several studies conducted by this division, which were either original contributions or a confirmation of the work of other statisticians, demonstrate the scope and type of statistical activities in the program.

It was found that the logarithm of the adjusted cancer death rate increased with the logarithm of the density of the population up to densities of about 4,000 persons per square mile and from there on remained practically constant (*2*).

Later, the reason for this relationship to density was found to be the high cancer death rate of the foreign-born and their children, both of whom have more cancer than native-born with native grandparents. This was particularly marked for cancer of the stomach.

It has been shown that persons with skin cancers are predisposed to other cancers of the skin. Males with lip cancers are somewhat predisposed to multiple skin cancers. There is no evidence that skin cancer provides immunity to other primary cancers (*3*).

There was a definite association between cancer of the buccal cavity and the use of tobacco (*4*).

Incidence of cancer among the husbands and wives of cancer patients was found to be no greater than for men and women in the general population.

Cancer of the cervix is correlated with marriage before the age of 20, divorce or separation at any time, unrepaired lacerations, last child born to women before age 25, and syphilis (*5*, *6*).

Cancer of the breast shows correlation with trauma, but the relationship may be more apparent than real.

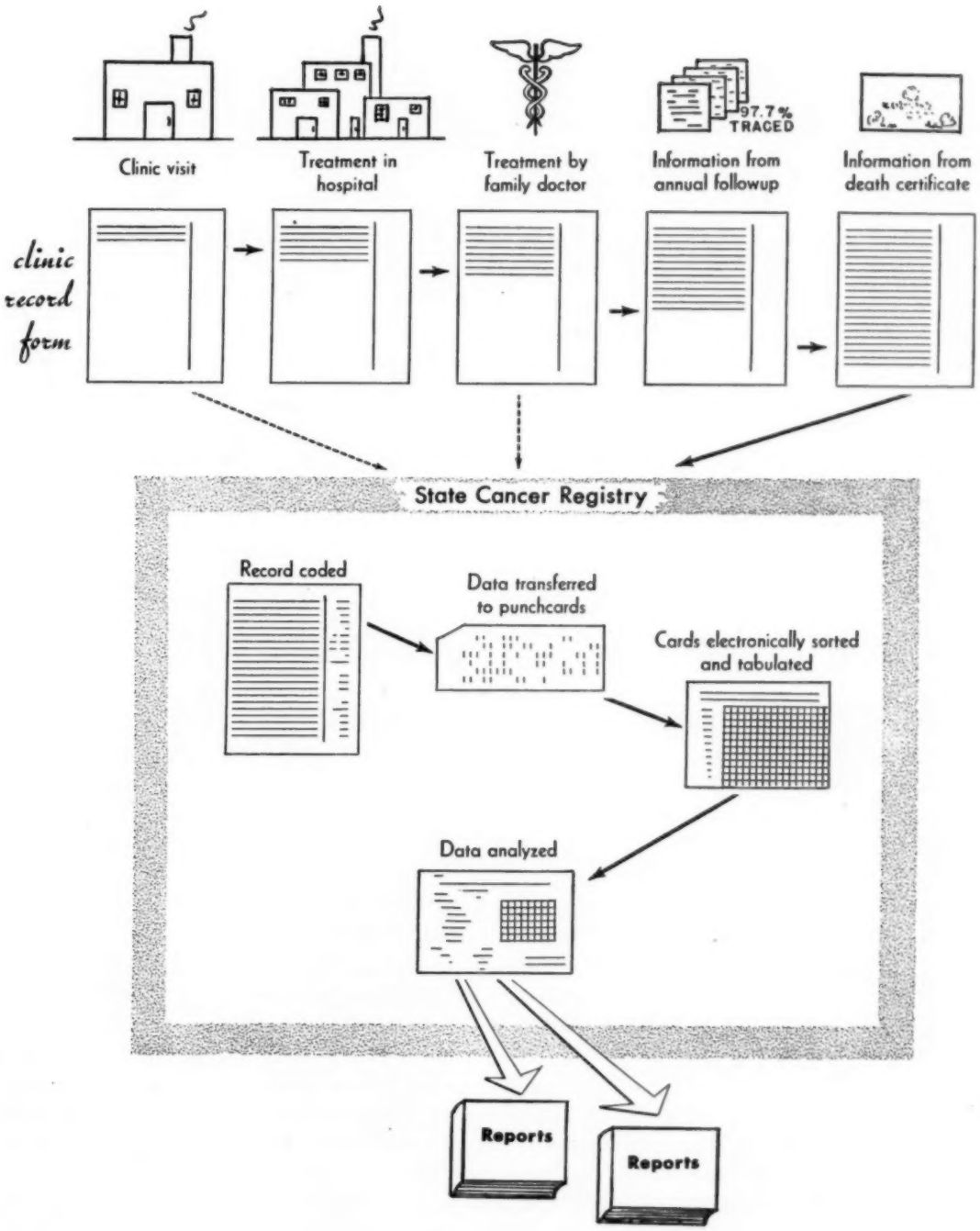
### Hospitalization

The Pondville Hospital, with 139 beds, and the Monsignor Roche wing of the Westfield State Sanatorium, with 50 beds, furnish hospital facilities for patients with cancer or suspected cancer of all types and stages who cannot otherwise be adequately cared for, have lived in Massachusetts for 2 out of the preceding 3 years, and are certified for admission by a practicing physician or dentist. Both institutions maintain outpatient clinics.

In Massachusetts less than 5 percent of cancer cases are cared for in the 2 State cancer hospitals. The present thinking envisions more and more service on the local level, not only for patients with operable cancers, but also for those needing palliative care.

While present trends indicate that few State cancer hospitals will be established, and that adequate service for the patient can be maintained through local institutions, one outgrowth of the cancer hospital program in Massachusetts is pertinent. During the 25 years in which Pondville Hospital has operated, 163 physicians have received specialized training in the treatment of malignant neoplasms. All had had residencies in other institutions. At the conclusion of their stay they were not only proficient in the diagnosis and treatment of cancer

# Evolution of the Cancer Clinic Record



but most of them were interested in the entire control program. Nearly half of them have opened offices in Massachusetts communities and the remainder in 28 other States and 2 foreign countries. This increase in the number of trained cancer personnel augurs well for better cancer service.

### Tumor Diagnosis Service

A free tumor diagnosis service is offered by the Massachusetts Department of Public Health in conjunction with the Cancer Commission of Harvard University. The service is purchased from the commission at $3 per specimen. Any physician or hospital may have suspected tissue examined pathologically. This service is used not only by those surgeons who do not have access to other facilities, but also by pathologists who desire confirmation of their diagnoses.

In the early 1930's approximately 2,500 specimens were examined yearly, and slightly over 500 physicians used the service. By 1940 these numbers had increased to 4,000 and 800, respectively. During the war years use of the service decreased, then increased rapidly, until in 1952 nearly 10,000 specimens were examined and 1,125 physicians used the service (see fig. 1).

**Figure 1. Number of surgical specimens examined at the tumor diagnosis laboratory and the number of physicians submitting the specimens, 1926–52.**


### Clinics

At the present time, 20 hospitals are maintaining State or State-aided cancer clinics. The 18 State-aided clinics are administered by committees composed of physicians appointed annually either by the local medical society or by the staff of a hospital. The staff serves without compensation and the State purchases certain services for the care of "such persons who may be in whole or in part unable to support or care for themselves" (7). The clinics furnish group diagnosis for any individual in Massachusetts whose physician suspects cancer. Individuals may come directly to the clinics, but it is more satisfactory to have them referred by the family physician, who has a knowledge of the patient's previous condition. Any resident of the State may receive an opinion from a cancer clinic regardless of his financial standing. A standard fee of $10 is paid by the few who are not medically indigent. Medical social service consultation is available and followup service is maintained for all cancer cases from the first admission until death. Only 2.3 percent of the individuals with cancer have been lost to followup service. Among women with cancer of the genital organs and of the breast, the percentage of lost cases is even less—1.5 and 1.6, respectively.

During the 26 years of operation over a hundred thousand new patients have attended the cancer clinics. About one-third have cancer, the predominating sites of which have been skin, breast, female genitals, and mouth. Only 14 percent of the new cancer cases in the State are examined in the State and the State-aided cancer clinics.

In the first year of the clinics 20 percent of the persons who attended were referred by physicians; by 1950 this percentage had increased to 86 percent. In 1950, nearly 20 percent of

**Percentage of persons admitted to cancer clinics who were referred by their family physicians, by years**

| Year | Percent | Year | Percent |
|---|---|---|---|
| 1927 | 20. 1 | 1940 | 80. 8 |
| 1928 | 29. 2 | 1941 | 81. 4 |
| 1929 | 34. 0 | 1942 | 84. 4 |
| 1930 | 35. 8 | 1943 | 84. 5 |
| 1931 | 37. 9 | 1944 | 83. 8 |
| 1932 | 42. 6 | 1945 | 84. 4 |
| 1933 | 45. 0 | 1946 | 84. 0 |
| 1934 | 47. 4 | 1947 | 82. 4 |
| 1935 | 58. 2 | 1948 | 83. 2 |
| 1936 | 67. 2 | 1949 | 84. 8 |
| 1937 | 74. 1 | 1950 | 86. 3 |
| 1938 | 78. 1 | 1951 | 84. 0 |
| 1939 | 79. 8 | | |

the persons having cancer came to a clinic within 2 months of the first recognizable symptoms. More than 80 percent of recommendations made at the clinics are now being carried out within 1 month of the clinic admission.

In the cancer clinics the median age of new patients with cancer of all sites except the urinary organs increased from 61.5 in 1930 to 66.0 in 1950. The percentage increase in the median age among women was over twice that among the men.

The clinic attendance greatly exceeds the number of new cases, since each year there are nearly 25,000 return visits of former cancer patients. Studies have shown that the presence of a clinic in a city increases the number of individuals seeking advice for cancer in the physician's private office.

The cost per patient "serviced" by the State-aided clinics at the present time is $4.30. (Patients "serviced" include those examined at the clinic, cancer patients who returned for check-ups, and former cancer patients visited in the home by a social worker.)

### Education

Cancer education of the physicians is accomplished largely through cancer clinics. The State health department issues an abstract bulletin four times a year which is sent to all physicians who request it. In 1940, and again in 1950 the department purchased and presented to every registered Massachusetts physician a 300-page book, "Cancer, a Manual for Practitioners," published by a local committee of the American Cancer Society.

In 1932, one of the most far-reaching events in medical education in the whole cancer clinic program occurred—the establishment of the first of the cured-cancer clinics. Patients who had been treated for cancer and had been free of disease for 5 years or longer agreed to be present at a clinic at which their case histories were reviewed. The diagnosis of each individual included as a "5-year cure" was verified by a reexamination of the original slide by three pathologists. Practically every site of cancer was represented and more than 150 5-year cured cases were shown.

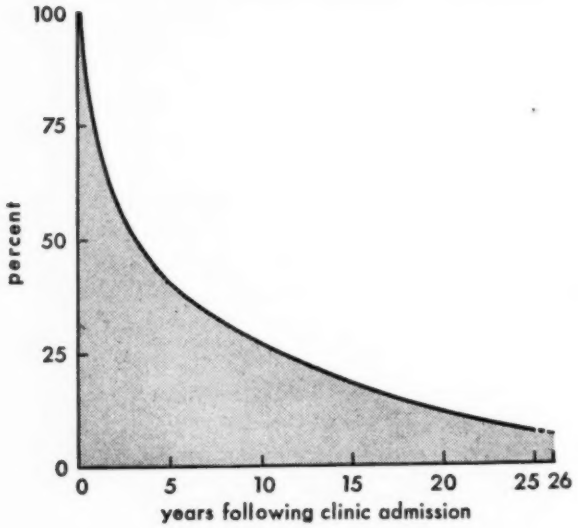
The percentage of surviving clinic patients who had cancer during the first 25 years of the program is shown in figure 2.

This cured-cancer clinic was followed by teaching clinics, which have enabled the general practitioner to see many more cases of cancer than he would have seen otherwise. Men experienced in cancer diagnosis and treatment, from Boston, New York, and other cities, have conducted these clinics, and the general medical practitioner has been invited to attend the clinic nearest his home. Many physicians who have found it difficult to spend 1 or 2 days in Boston can easily arrange to spend 2 or 3 hours at the local clinic. Between 1933 and the present time, 490 teaching clinics have been held with an attendance of 12,661 physicians.

A cancer institute for nurses is held twice yearly. This institute consists of a concentrated 2-week period of instruction and observation at Pondville Hospital, the State-aided cancer clinics, and various institutions. The course includes discussion of the various sites of cancer from the surgical, pathological, radiological, and nursing points of view, and seminars on the public health aspects of cancer control. The number of nurses attending the institute is limited in order that each nurse may be given individual attention.

Other methods of cancer education have included instruction of medical students, lectures to professional groups, such as nurses, doctors, and public health workers, the distribution of literature and posters, radio broadcasts, and instruction in the schools. The Massachusetts

**Figure 2. Survival of clinic patients with cancer during 25 years of Massachusetts program.**

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The small number of cancers found among asymptomatic subjects would have been greatly increased if applicants with symptoms had been accepted by the center.

The place for examination of persons with symptoms is the private physician's office or a cancer diagnostic clinic rather than a detection center.

The few cancers found among asymptomatic persons, as well as the high cost of each examination, precludes large-scale financing of cancer detection centers by either governmental or voluntary agencies.

Many of the procedures carried out at the detection center probably could be done by the general practitioner if proper instruments were available to him at a reasonable cost and if he were willing to spend sufficient time in taking a history and making an examination.

A 6-year experimental study, financed in part by the Commonwealth Fund, was inaugurated in January 1945 by the Massachusetts Department of Public Health to evaluate, from an administrative standpoint, the use of vaginal smears in the diagnosis of uterine cancer (*14*). The incidence of uterine cancer among women without gynecologic symptoms was found to be less than 1 percent; among those with bleeding, over 30 percent; and among those with other gynecologic symptoms, about 10 percent. If questionable smears were considered positive, since they indicate the need for further study, the overall error among symptomless subjects would be at least 4 percent, and among those with bleeding, at least 16 percent. The percentage of questionable diagnoses was about 4 times as great among those with bleeding as among those who did not mention bleeding. It does not seem feasible for a State health department to offer this test on an extensive scale for women without gynecologic symptoms, since the cost would be prohibitive and the number of cancers found would be relatively few.

Perhaps the outstanding feature of the Massachusetts cancer control program is the feeling of personal responsibility that has been generated. The program, while technically a State health department activity, has so stimulated other agencies, other groups, other individuals, that it is as much a Massachusetts project as a health department activity. The cancer unit of the Harvard School of Public Health, the American Cancer Society, Massachusetts Division, Inc., the Cancer Committee of the Massachusetts Medical Society, and individuals from many walks of life have contributed to the success of the program. The interchange can be visualized best by noting the composition of the advisory committee of the program, together with the two ex officio members. These 7 physicians have the following affiliations: 5 are directors of the American Cancer Society; 3 are members of the Cancer Committee of the Massachusetts Medical Society; 4 are teachers at the Harvard School of Public Health; 6 are teachers at medical schools; and 1 is on the faculty of a dental school.

This epitomizes cancer control in Massachusetts during the last quarter century. One cannot postulate that all of the improvement has been due to the Massachusetts cancer program. The American Cancer Society has functioned

for over a quarter of a century. The American College of Surgeons has been extremely active in cancer control and in the last few years the Federal Government has inaugurated an extensive cancer control program. There may even be forces at work of a biological nature of which we have no knowledge. However, it seems reasonable to assume that a part of this improvement is due to the tireless efforts of those groups of individuals who have participated in the Massachusetts cancer control program.

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## Undersecretary of Health, Education, and Welfare

The presidential appointment of Nelson A. Rockefeller as Undersecretary of Health, Education, and Welfare was confirmed by the United States Senate on June 10, 1953.

Mr. Rockefeller, Assistant Secretary of State in charge of relations with the American Republics from December 1944 to August 1945, was Coordinator of the Office of Inter-American Affairs from 1940 to 1944. In 1950, he was chairman of the International Development Advisory Board, charged with recommending general policy toward underdeveloped areas.

In November 1952, President-elect Eisenhower appointed Mr. Rockefeller chairman of a committee to review studies for streamlining the executive branch of the Government. The committee was given official status as the President's Advisory Committee on Government Organization by President Eisenhower's first executive order.

At the time of his appointment, Mr. Rockefeller was president of the International Basic Economy Corporation (IBEC) and president of the American International Association (AIA) for Economic and Social Development. He was also chairman of the board of the IBEC Research Institute and chairman of the IBEC Technical Services Corporation.

IBEC is engaged in joint business enterprises, chiefly in Venezuela and Brazil, to produce and distribute essential goods. AIA, a nonprofit organization established to help raise living standards in underdeveloped areas, provides educational services for improving agriculture and rural life. The IBEC Research Institute is a nonprofit corporation which conducts research in tropical agriculture. IBEC Technical Services provides technical services to foreign countries in the fields of public works and economic development.

# Effect of Public Law 779 On Teaching and Research At Public Health Schools

By W. H. Aufranc, M.D., and William P. Shepard, M.D.

For the majority of persons serving in understaffed health departments and directly concerned with meeting day-to-day public health needs in their communities, the recently published paper (*1*) on health department manpower shortages was probably far from startling when it revealed that budgeted vacancies amounted to 20 percent for physicians, 9 percent for nurses, and 14 percent for sanitary engineers. But by presenting clearly and concretely the staffing deficiencies in State and local public health departments, a real need has been fulfilled by this study which was sponsored by the Health Resources Advisory Committee of the Office of Defense Mobilization and conducted by the Public Health Service. Now that the nature and scope of the problem have been specifically delineated, the deficits of trained personnel in health departments will receive the attention and interest of many more agencies and individuals at local, State, and national levels.

The reported deficits of physicians and nurses offer an incentive for medical and nursing schools to place more emphasis on public health in their curriculums and in their counseling programs. The same holds true for other categories of personnel.

Partly as a result of the findings in the study of manpower in health departments, the Health Resources Advisory Committee surveyed for a second time the faculties of schools of public health to appraise the impacts of Public Law 779 on their teaching and research programs. The information available for 1950–51 and 1952–53 is now being used by the State and local advisory committees to the Selective Service System in determining the essentiality and availability of individual physicians. The data will also serve as a benchmark in staffing and will be useful for mobilization and other planning to meet public health needs.

*Dr. Aufranc, formerly assistant chief of the Division of Venereal Disease, Public Health Service, is now director of the Health Resources Staff and Dr. Shepard is a member of the Health Resources Advisory Committee, Office of Defense Mobilization.* *This paper is adapted from remarks given by Dr. Shepard at the 80th annual meeting of the American Public Health Association in Cleveland, 1952.*

**Public Law 779**

Public Law 779, a 1950 amendment to the 1948 Selective Service Act, required registration of all men under 50 years of age in medical, dental, and allied specialist categories, if they were not members of a reserve component of the Armed Forces.

Priority I. Men who pursued their professional education either through occupational deferment or through participation in the specialized training programs of the Army or Navy and had less than 90 days of subsequent military service.

Priority II. Same groups as I, under the same conditions, who had 90 days or more but less than 21 months of subsequent active duty.

Priority III. Men in the specified categories with no active duty since September 16, 1940.

Priority IV. Veterans not covered by priorities I and II.

## Findings

For an enrollment of approximately 800 graduate students, the 10 approved schools of public health in the United States reported a faculty of 467 teachers and research workers at the start of the 1952–53 school year. This complement represented a slight reduction from the 488 reported for 1950–51; however, at least a part of the decrease is due to a difference between the 2 years in the definition of faculty members to be included. Some schools, for example, excluded from their 1952–53 reports occasional lecturers who had been included in their 1950–51 reports (table 1).

**Table 1. Faculty members at schools of public health, by profession, 1950–51 and 1952–53**

| Profession | Year of report | |
|---|---|---|
| | 1950–51 | 1952–53 |
| Total | 488 | 467 |
| Physicians | 187 | 179 |
| Dentists | 2 | |
| Veterinarians | 2 | 1 |
| Others | 297 | 287 |

To get a more accurate measure of teaching programs in schools of public health than total numbers of faculty members, the Health Resources Advisory Committee in their 1952–53 survey asked the total number of teaching hours for those faculty members with teaching assignments. The reports showed about 84 percent of the faculty members held teaching assignments with some of them devoting as many as 1,000 hours per year. The remaining 15 percent of the faculty members were engaged exclusively in research (table 2).

Since almost all the faculty members with teaching assignments devote a considerable portion of their time to research and community services, the typical teaching schedule of formal classroom time was relatively low. About 46 percent of the faculty members with teaching assignments reported less than 200 annual hours of formal classroom instruction. When all 10 schools are grouped, the total hours of formal classroom instruction on an overall basis amounted to 145,000 hours or about 150 to 200 hours per student a year. The individual schools, however, showed marked variations from this overall average, probably because they differed so much from one another by type of enrollment.

**Table 2. Total annual classroom teaching hours of faculty members at schools of public health, 1952–53**

| Annual hours | Total | Physicians | Nurses | Others |
|---|---|---|---|---|
| Total | 467 | 179 | 22 | 266 |
| No teaching | 71 | 17 | 1 | 53 |
| Under 100 | 105 | 52 | 2 | 51 |
| 100–199 | 70 | 30 | 5 | 35 |
| 200–299 | 42 | 17 | 2 | 23 |
| 300–399 | 44 | 19 | 5 | 20 |
| 400–499 | 30 | 17 | 1 | 12 |
| 500–599 | 10 | 6 | | 4 |
| 600–699 | 17 | 4 | 1 | 12 |
| 700–799 | 8 | 5 | | 3 |
| 800–899 | 5 | 2 | | 3 |
| 900–999 | 5 | | | 5 |
| 1,000 and over | 41 | 6 | 1 | 34 |
| Unknown | 19 | 4 | 4 | 11 |

An analysis of the classroom teaching hours by academic title and age revealed that most instruction is provided by faculty members with the academic title of associate or assistant professor and that, in general, younger faculty members carry the heaviest teaching schedules.

The percentage of total classroom teaching time contribued in 1952–53 by faculty members according to academic title is given below:

| | *Percent time* |
|---|---|
| Professors | 23.6 |
| Associate and assistant professors | 42.3 |
| Associates and assistants | 11.1 |
| Instructors | 8.7 |
| Visiting lecturers | 9.0 |
| Others | 5.3 |

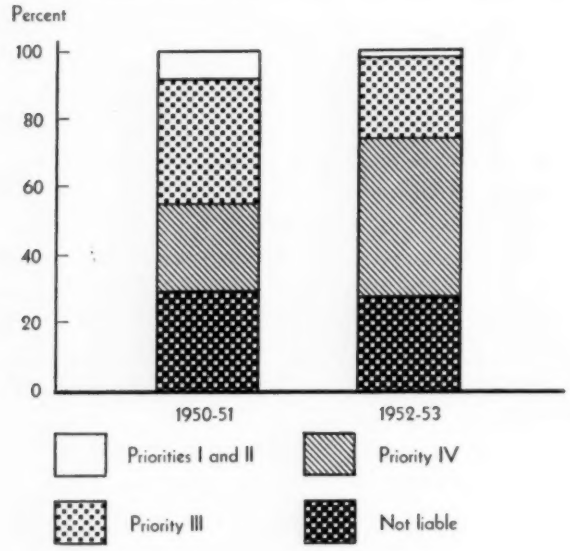
Following are the average annual hours of classroom teaching time contributed by faculty members in each age group:

| *Age group* | *Average annual hours* |
|---|---|
| 20–29 | 426 |
| 30–39 | 379 |
| 40–49 | 366 |
| 50 plus | 304 |

Roughly one-third of the total teaching time in schools of public health during 1952–53 was provided by faculty members in professions covered by Public Law 779. Accordingly, it is especially important for the schools to consider carefully the military liability of these individuals in making faculty appointments. In general, the surveys of the Health Resources Advisory Committee show that they have done this. As a result, they are in a much better position today than they were in 1950–51 (see chart).

As expected, the proportion of men in the first two priorities under Public Law 779 is markedly lower at present than in 1950–51. In

**Military liability of faculty members covered by Public Law 779 at schools of public health, 1950–51 and 1952–53**




NOTE: Included in the "not liable" group are men over 50 years of age, women, and aliens.

the near future, all men in the first two priorities will have been called for military service, and men with no previous military service, those in priority III, will become liable. On an overall basis, although the picture may be quite different from the viewpoint of the individual schools, the faculty members in priority III contributed 9 percent of the total teaching hours. Men in priority III will be called according to age with the youngest first. It is doubtful if those in the extreme upper-age groups will ever be called at present mobilization levels since more and more of the newly graduated physicians are nonveterans and, therefore, will be registered in priority III. The age distribution of the priority III physicians on faculties at schools of public health follows:

| *Age group* | *Percent physicians* |
|---|---|
| Under 35 | 12.5 |
| 35–39 | 20.0 |
| 40–44 | 30.0 |
| 45 plus | 37.5 |

## Conclusion

The surveys of the Health Resources Advisory Committee show that schools of public health depend on individuals in professions covered by Public Law 779 for more than one-third of their total faculty members. It is, therefore, extremely important for them to follow closely the scheduling of military liability under the law. A comparison of 1950–51 data with 1952–53 information shows that, in general, they have done this. Priority III, the next group in line for military service, at schools of public health contribute roughly 9 percent of the total teaching time. Schools with priority III faculty members in the younger age groups should prepare to obtain replacements now to avoid disruption at a later date.

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# Immune Serum Globulin

## in the prophylaxis of

The summer of 1953 promises to place a tremendous burden on public health administration and private medical practice in the United States in a basic field—that of control of a communicable disease: poliomyelitis. These months could well represent a historical moment in the many-faceted scientific attack on this intriguing and complex virus disease. And this year may well, also, witness the safeguarding of many children from the paralytic effects of poliomyelitis.

On the following pages are presented several basic source and background documents bearing on the distribution and use of immune serum globulin (gamma globulin) in connection with the prophylaxis of paralytic poliomyelitis and other diseases.

paralytic poliomyelitis

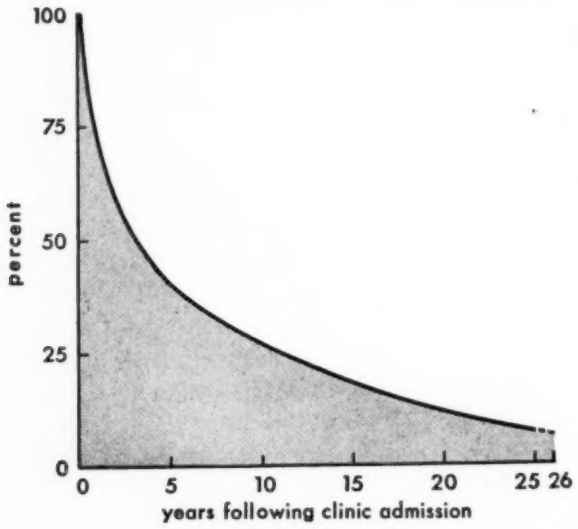
measles

infectious hepatitis

hypogammaglobulinemia

READER'S GUIDE

**Figure 2. Survival of clinic patients with cancer during 25 years of Massachusetts program.**

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Many of the procedures carried out at the detection center probably could be done by the general practitioner if proper instruments were available to him at a reasonable cost and if he were willing to spend sufficient time in taking a history and making an examination.

A 6-year experimental study, financed in part by the Commonwealth Fund, was inaugurated in January 1945 by the Massachusetts Department of Public Health to evaluate, from an administrative standpoint, the use of vaginal smears in the diagnosis of uterine cancer (*14*). The incidence of uterine cancer among women without gynecologic symptoms was found to be less than 1 percent; among those with bleeding, over 30 percent; and among those with other gynecologic symptoms, about 10 percent. If questionable smears were considered positive, since they indicate the need for further study, the overall error among symptomless subjects would be at least 4 percent, and among those with bleeding, at least 16 percent. The percentage of questionable diagnoses was about 4 times as great among those with bleeding as among those who did not mention bleeding. It does not seem feasible for a State health department to offer this test on an extensive scale for women without gynecologic symptoms, since the cost would be prohibitive and the number of cancers found would be relatively few.

Perhaps the outstanding feature of the Massachusetts cancer control program is the feeling of personal responsibility that has been generated. The program, while technically a State health department activity, has so stimulated other agencies, other groups, other individuals, that it is as much a Massachusetts project as a health department activity. The cancer unit of the Harvard School of Public Health, the American Cancer Society, Massachusetts Division, Inc., the Cancer Committee of the Massachusetts Medical Society, and individuals from many walks of life have contributed to the success of the program. The interchange can be visualized best by noting the composition of the advisory committee of the program, together with the two ex officio members. These 7 physicians have the following affiliations: 5 are directors of the American Cancer Society; 3 are members of the Cancer Committee of the Massachusetts Medical Society; 4 are teachers at the Harvard School of Public Health; 6 are teachers at medical schools; and 1 is on the faculty of a dental school.

This epitomizes cancer control in Massachusetts during the last quarter century. One cannot postulate that all of the improvement has been due to the Massachusetts cancer program. The American Cancer Society has functioned

for over a quarter of a century. The American College of Surgeons has been extremely active in cancer control and in the last few years the Federal Government has inaugurated an extensive cancer control program. There may even be forces at work of a biological nature of which we have no knowledge. However, it seems reasonable to assume that a part of this improvement is due to the tireless efforts of those groups of individuals who have participated in the Massachusetts cancer control program.

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## Undersecretary of Health, Education, and Welfare

The presidential appointment of Nelson A. Rockefeller as Undersecretary of Health, Education, and Welfare was confirmed by the United States Senate on June 10, 1953.

Mr. Rockefeller, Assistant Secretary of State in charge of relations with the American Republics from December 1944 to August 1945, was Coordinator of the Office of Inter-American Affairs from 1940 to 1944. In 1950, he was chairman of the International Development Advisory Board, charged with recommending general policy toward underdeveloped areas.

In November 1952, President-elect Eisenhower appointed Mr. Rockefeller chairman of a committee to review studies for streamlining the executive branch of the Government. The committee was given official status as the President's Advisory Committee on Government Organization by President Eisenhower's first executive order.

At the time of his appointment, Mr. Rockefeller was president of the International Basic Economy Corporation (IBEC) and president of the American International Association (AIA) for Economic and Social Development. He was also chairman of the board of the IBEC Research Institute and chairman of the IBEC Technical Services Corporation.

IBEC is engaged in joint business enterprises, chiefly in Venezuela and Brazil, to produce and distribute essential goods. AIA, a nonprofit organization established to help raise living standards in underdeveloped areas, provides educational services for improving agriculture and rural life. The IBEC Research Institute is a nonprofit corporation which conducts research in tropical agriculture. IBEC Technical Services provides technical services to foreign countries in the fields of public works and economic development.

# Effect of Public Law 779 On Teaching and Research At Public Health Schools

By W. H. Aufranc, M.D., and William P. Shepard, M.D.

For the majority of persons serving in understaffed health departments and directly concerned with meeting day-to-day public health needs in their communities, the recently published paper (*1*) on health department manpower shortages was probably far from startling when it revealed that budgeted vacancies amounted to 20 percent for physicians, 9 percent for nurses, and 14 percent for sanitary engineers. But by presenting clearly and concretely the staffing deficiencies in State and local public health departments, a real need has been fulfilled by this study which was sponsored by the Health Resources Advisory Committee of the Office of Defense Mobilization and conducted by the Public Health Service. Now that the nature and scope of the problem have been specifically delineated, the deficits of trained personnel in health departments will receive the attention and interest of many more agencies and individuals at local, State, and national levels.

The reported deficits of physicians and nurses offer an incentive for medical and nursing schools to place more emphasis on public health in their curriculums and in their counseling programs. The same holds true for other categories of personnel.

Partly as a result of the findings in the study of manpower in health departments, the Health Resources Advisory Committee surveyed for a second time the faculties of schools of public health to appraise the impacts of Public Law 779 on their teaching and research programs. The information available for 1950–51 and 1952–53 is now being used by the State and local advisory committees to the Selective Service System in determining the essentiality and availability of individual physicians. The data will also serve as a benchmark in staffing and will be useful for mobilization and other planning to meet public health needs.

*Dr. Aufranc, formerly assistant chief of the Division of Venereal Disease, Public Health Service, is now director of the Health Resources Staff and Dr. Shepard is a member of the Health Resources Advisory Committee, Office of Defense Mobilization.* *This paper is adapted from remarks given by Dr. Shepard at the 80th annual meeting of the American Public Health Association in Cleveland, 1952.*

**Public Law 779**

Public Law 779, a 1950 amendment to the 1948 Selective Service Act, required registration of all men under 50 years of age in medical, dental, and allied specialist categories, if they were not members of a reserve component of the Armed Forces.

Priority I. Men who pursued their professional education either through occupational deferment or through participation in the specialized training programs of the Army or Navy and had less than 90 days of subsequent military service.

Priority II. Same groups as I, under the same conditions, who had 90 days or more but less than 21 months of subsequent active duty.

Priority III. Men in the specified categories with no active duty since September 16, 1940.

Priority IV. Veterans not covered by priorities I and II.

## Findings

For an enrollment of approximately 800 graduate students, the 10 approved schools of public health in the United States reported a faculty of 467 teachers and research workers at the start of the 1952–53 school year. This complement represented a slight reduction from the 488 reported for 1950–51; however, at least a part of the decrease is due to a difference between the 2 years in the definition of faculty members to be included. Some schools, for example, excluded from their 1952–53 reports occasional lecturers who had been included in their 1950–51 reports (table 1).

**Table 1. Faculty members at schools of public health, by profession, 1950–51 and 1952–53**

| Profession | Year of report | |
|---|---|---|
| | 1950–51 | 1952–53 |
| Total | 488 | 467 |
| Physicians | 187 | 179 |
| Dentists | 2 | |
| Veterinarians | 2 | 1 |
| Others | 297 | 287 |

To get a more accurate measure of teaching programs in schools of public health than total numbers of faculty members, the Health Resources Advisory Committee in their 1952–53 survey asked the total number of teaching hours for those faculty members with teaching assignments. The reports showed about 84 percent of the faculty members held teaching assignments with some of them devoting as many as 1,000 hours per year. The remaining 15 percent of the faculty members were engaged exclusively in research (table 2).

Since almost all the faculty members with teaching assignments devote a considerable portion of their time to research and community services, the typical teaching schedule of formal classroom time was relatively low. About 46 percent of the faculty members with teaching assignments reported less than 200 annual hours of formal classroom instruction. When all 10 schools are grouped, the total hours of formal classroom instruction on an overall basis amounted to 145,000 hours or about 150 to 200 hours per student a year. The individual schools, however, showed marked variations from this overall average, probably because they differed so much from one another by type of enrollment.

**Table 2. Total annual classroom teaching hours of faculty members at schools of public health, 1952–53**

| Annual hours | Total | Physicians | Nurses | Others |
|---|---|---|---|---|
| Total | 467 | 179 | 22 | 266 |
| No teaching | 71 | 17 | 1 | 53 |
| Under 100 | 105 | 52 | 2 | 51 |
| 100–199 | 70 | 30 | 5 | 35 |
| 200–299 | 42 | 17 | 2 | 23 |
| 300–399 | 44 | 19 | 5 | 20 |
| 400–499 | 30 | 17 | 1 | 12 |
| 500–599 | 10 | 6 | | 4 |
| 600–699 | 17 | 4 | 1 | 12 |
| 700–799 | 8 | 5 | | 3 |
| 800–899 | 5 | 2 | | 3 |
| 900–999 | 5 | | | 5 |
| 1,000 and over | 41 | 6 | 1 | 34 |
| Unknown | 19 | 4 | 4 | 11 |

An analysis of the classroom teaching hours by academic title and age revealed that most instruction is provided by faculty members with the academic title of associate or assistant professor and that, in general, younger faculty members carry the heaviest teaching schedules.

The percentage of total classroom teaching time contribued in 1952–53 by faculty members according to academic title is given below:

| | *Percent time* |
|---|---|
| Professors | 23.6 |
| Associate and assistant professors | 42.3 |
| Associates and assistants | 11.1 |
| Instructors | 8.7 |
| Visiting lecturers | 9.0 |
| Others | 5.3 |

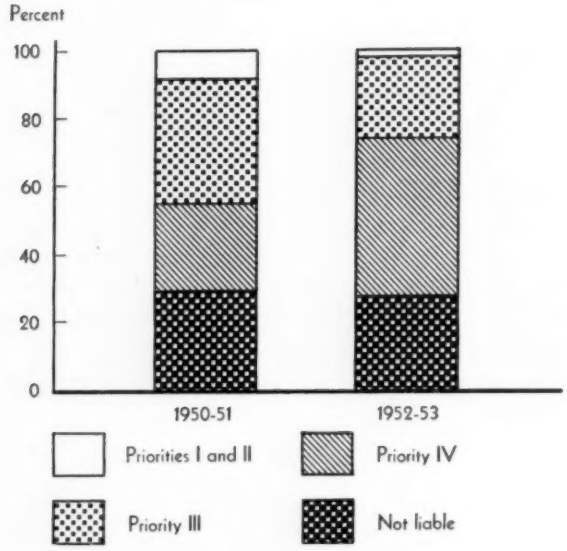
Following are the average annual hours of classroom teaching time contributed by faculty members in each age group:

| *Age group* | *Average annual hours* |
|---|---|
| 20–29 | 426 |
| 30–39 | 379 |
| 40–49 | 366 |
| 50 plus | 304 |

Roughly one-third of the total teaching time in schools of public health during 1952–53 was provided by faculty members in professions covered by Public Law 779. Accordingly, it is especially important for the schools to consider carefully the military liability of these individuals in making faculty appointments. In general, the surveys of the Health Resources Advisory Committee show that they have done this. As a result, they are in a much better position today than they were in 1950–51 (see chart).

As expected, the proportion of men in the first two priorities under Public Law 779 is markedly lower at present than in 1950–51. In

**Military liability of faculty members covered by Public Law 779 at schools of public health, 1950–51 and 1952–53**




NOTE: Included in the "not liable" group are men over 50 years of age, women, and aliens.

the near future, all men in the first two priorities will have been called for military service, and men with no previous military service, those in priority III, will become liable. On an overall basis, although the picture may be quite different from the viewpoint of the individual schools, the faculty members in priority III contributed 9 percent of the total teaching hours. Men in priority III will be called according to age with the youngest first. It is doubtful if those in the extreme upper-age groups will ever be called at present mobilization levels since more and more of the newly graduated physicians are nonveterans and, therefore, will be registered in priority III. The age distribution of the priority III physicians on faculties at schools of public health follows:

| *Age group* | *Percent physicians* |
|---|---|
| Under 35 | 12.5 |
| 35–39 | 20.0 |
| 40–44 | 30.0 |
| 45 plus | 37.5 |

## Conclusion

The surveys of the Health Resources Advisory Committee show that schools of public health depend on individuals in professions covered by Public Law 779 for more than one-third of their total faculty members. It is, therefore, extremely important for them to follow closely the scheduling of military liability under the law. A comparison of 1950–51 data with 1952–53 information shows that, in general, they have done this. Priority III, the next group in line for military service, at schools of public health contribute roughly 9 percent of the total teaching time. Schools with priority III faculty members in the younger age groups should prepare to obtain replacements now to avoid disruption at a later date.

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# Immune Serum Globulin

## in the prophylaxis of

The summer of 1953 promises to place a tremendous burden on public health administration and private medical practice in the United States in a basic field—that of control of a communicable disease: poliomyelitis. These months could well represent a historical moment in the many-faceted scientific attack on this intriguing and complex virus disease. And this year may well, also, witness the safeguarding of many children from the paralytic effects of poliomyelitis.

On the following pages are presented several basic source and background documents bearing on the distribution and use of immune serum globulin (gamma globulin) in connection with the prophylaxis of paralytic poliomyelitis and other diseases.

paralytic poliomyelitis

measles

infectious hepatitis

hypogammaglobulinemia

READER'S GUIDE

# The Distribution and Use of Gamma Globulin

a statement issued April 20, 1953, by the Division of Medical Sciences of the National Research Council

During the past few months, wide publicity has been given to the results of studies indicating that a fraction of human plasma, known as gamma globulin, has some value as a prophylactic agent for paralytic poliomyelitis. As a result of this publicity, an overwhelming demand for the material may be anticipated in the coming months. The purpose of the present document is to outline the steps that have been taken to meet this situation and to discuss briefly the principles on which current plans for the distribution of gamma globulin have been based.

The supply of gamma globulin is severely limited. It is estimated that the maximum amount available this summer will not exceed 10,000 liters. Even if this were all used for the prophylaxis of poliomyelitis in children, it would provide less than one and a half million average doses. Moreover, the dose would be large enough only to give protection for 4 to 5 weeks. How inadequate is this supply to meet the demand will be evident when it is recalled that there are some 40 million children in the United States of America under 15 years of age.

The situation is even less favorable than these figures indicate. Gamma globulin contributes to the public health in ways other than in the prophylaxis of poliomyelitis. It is well established as a valuable agent in the control of measles and of infectious hepatitis. It is proving its effectiveness in the treatment of the rare condition of hypogammaglobulinemia. Provision must be made to reserve amounts of gamma globulin adequate to meet these needs. Furthermore, since gamma globulin is a product derived from human blood, consideration must be given to the requirements of military and civilian services for whole blood, plasma and albumin. To maintain a well-balanced National Blood Program, blood collected by the American National Red Cross must be wisely apportioned between these varied needs.

Shortly after the outbreak of the Korean War, it was recognized that the competing demands of several Government agencies for blood and the derivatives of blood might become acute. To assure an equitable distribution, the Office of Defense Mobilization was assigned the task of coordinating the National Blood Program. Late in 1952, the evidence for the value of gamma globulin in the prophylaxis of poliomyelitis was first published. Realizing that this new development would lead to an extreme demand for gamma globulin during the next poliomyelitis season, the Office of Defense Mobilization turned to the National Research Council for advice. In response, the Council appointed a panel of experts in public health services, epidemiology and poliomyelitis to study the problem. There was general agreement that the equitable and effective use of available supplies of gamma globulin could be achieved only by the adoption of a system of controlled distribution. In consultation with the foremost authorities on poliomyelitis, an allocation program was devised and submitted to the Office of Defense Mobilization. The recommendations of the panel were approved in principle by the Health Resources Advisory Committee, Office of Defense Mobilization, on April 15, 1953. The plan, in the form which has been communicated to all health authorities, appears on pages 666–668 of this issue of *Public Health Reports*. The discussion that follows is a brief review of the nature of gamma globulin,

the amounts that are expected to be available this summer and the criteria on which the effective use of the material should be based.

### Gamma Globulin

Gamma globulin is the name given to one of several fractions of the protein component of human plasma. It is comparable with the product officially known as immune serum globulin. Gamma globulin is prepared commercially by a method involving a series of precipitations with varying concentrations of alcohol under controlled conditions of acidity and low temperature. An average donation of blood (500 cc.) yields 7 cc. of a 16-percent solution of gamma globulin. This represents a single recommended dose for the prophylaxis of poliomyelitis in a 50-pound (6–7-year-old) child.

The production capacity of existing fractionating plants is limited.

### The Administration of Gamma Globulin

Gamma globulin is available as a 16-percent solution. This solution is opalescent and somewhat viscous, necessitating injection through a No. 18 or 20 needle for quantities required for the prophylaxis of poliomyelitis. Injections should be made intramuscularly, using a separate syringe and needle for each subject. Gamma globulin should never be given by the intravenous route.

The use of separate syringes is recommended because of the danger of contamination of the syringe with blood containing the virus of homologous serum hepatitis. This may occur when one attempts to withdraw blood in order to be certain that the needle point is not in a vein. It is for this reason that the repeated use of the same syringe carries the hazard of the transmission of homologous serum jaundice. No instance of hepatitis has been recorded following the use of gamma globulin which has been prepared and administered in the manner described above.

The intramuscular injection of gamma globulin is not accompanied by any significant reactions. The danger of local or systemic reactions must, however, be considered if repeated injections are contemplated.

### Measles

A dose of 0.1 cc. per pound body weight, when given soon after exposure, will prevent infection in most cases. When given later in the incubation period, this dose will result in modification of the disease. A dose of 0.02 cc. per pound body weight will usually modify the severity of the attack if given soon after exposure to infection.

In general, modification is to be preferred to prevention. Because of the seriousness of the disease in the younger age group, it is suggested that modification be attempted in all children below the age of 3 years who have been exposed to infection.

Prevention rather than modification may be warranted in hospital situations involving debilitated children and in individual cases where there is concurrent serious disease such as clinically active childhood tuberculosis.

The selection of exposed children rarely presents difficulties since the contact is almost always a frank clinical case and the time of exposure can frequently be determined. A history of a previous attack of measles should suffice to distinguish immune from susceptible children, and thus determine the need for prophylaxis following exposure.

### Infectious Hepatitis

Evidence for the effectiveness of gamma globulin in the prophylaxis of epidemic infectious hepatitis is of recent origin. The dose recommended at the present time is 0.02 cc. per pound body weight. There is evidence that lower doses will modify the disease. Further studies are in progress to determine the optimum dose range.

The indications for use are less sharply delineated than they are with measles. Inapparent infections may occur and may contribute to the spread of the disease and to the difficulty in identifying susceptible individuals. Moreover, the infection may be spread by means other than direct contact. In food-borne and water-borne outbreaks, control measures directed at the vehicle of transmission should be imposed and may be supplemented by the prophylactic use of gamma globulin.

Gamma globulin should be most useful in the control of sharp outbreaks in the armed forces and in civilian groups where adequate hygienic measures cannot readily be imposed. In the general population, prophylaxis with gamma globulin among the family and intimate contacts of cases would appear to be desirable. At the same time, hygienic controls and the typhoid-type of isolation of nonicteric as well as jaundiced cases should be instituted.

### Hypogammaglobulinemia

This clinical entity has only recently been described (*1*). It is a rare anomaly characterized by a deficient ability to form antibodies. The essential clinical manifestation is the frequent recurrence of severe infections. Laboratory evidence of the condition may be obtained from electrophoretic analyses of the gamma globulin content of the plasma of the patient and from immunological assays. In this condition, the regular repeated administration of gamma globulin is required to maintain the resistance of the patient to infection. As yet there has been little experience with this treatment and dosages have not been adequately established. The physician must be prepared to adjust the dose to the individual response.

### Poliomyelitis

Two reports (*2, 3*) by Dr. W. McD. Hammon and his associates are available on the epidemiological studies which form the basis for the use of gamma globulin in the prophylaxis of paralytic poliomyelitis. The children investigated ranged in age from 1 to 11 years and the doses used were 4, 7, or 11 cc. depending on the weight of the child. The average dose approximated 0.14 cc. per pound body weight.

Significant protection was demonstrated from the second through the fifth week following injection and diminishing protection was evident from the sixth to the eighth week. There was no significant difference in the number of cases of poliomyelitis in the treated and control groups in the week following injection, but there was evidence of mitigation of paralysis in the cases occurring in the children who had received gamma globulin. This evidence is the basis for the conclusion that gamma globulin will be most effective if given shortly before or as soon as possible after infection. It is of no value after clinical symptoms of the disease have become apparent (*4*).

#### *Criteria for Diagnosis*

It will be noted that the basis for allocation to the States is dependent upon the reported incidence of the disease, with the suggestion that the incidence of paralytic cases may be used as a control in making additional and supplemental allocations.

To insure uniform reporting it is suggested that physicians and health departments adopt criteria for diagnosis similar to those formulated by the National Conference on Recommended Practices for the Control of Poliomyelitis (*5*). The following is an excerpt from the above document.

"Diagnostic criteria of paralytic or nonparalytic poliomyelitis should generally include three or more of the following:

1) history compatible with poliomyelitis,
2) fever,
3) stiff neck and/or stiff back,
4) 10 to 500 cells per cc. of spinal fluid taken during the acute or early convalescent period of the disease,
5) spinal fluid protein elevated above normal limits,
6) demonstrable muscle weakness or paralysis.

"Cases which present only (1) history compatible with poliomyelitis, and (2) fever, should be classified as presumptive (abortive) poliomyelitis.

"Paralytic cases are defined as those in which definite weakness or paralysis has been detected and persisted during at least two examinations made at intervals of at least several hours. Results of an examination for paralysis of muscles of the extremities or trunk may be very unreliable during the period of muscle tenderness or 'spasm'."

#### *Community Prophylaxis*

Community prophylaxis of age groups at the greatest risk is indicated only in areas in which the incidence is exceptionally high and the onset

of the epidemic is abrupt. In Hammon's studies in Harris County, Texas, where the epidemic rate was 82/100,000, only 0.4 cases were prevented per 1,000 injections. The effectiveness rose to 3.4 per 1,000 in the Iowa study where the epidemic rate was nearly 400/100,000. A further difference between these two epidemics lay in the fact that the former was prolonged over many months whereas the majority of the cases in Iowa occurred in a period of 2 months. The effectiveness of mass prophylaxis is proportional to the incidence of the disease in the selected age group during the few weeks following injection and is influenced by the intensity of the outbreak as distinct from its ultimate rate. Mass prophylaxis is most effective if instituted about 3 weeks prior to the peak of an unusually intense epidemic.

Unfortunately, the prediction of the course and duration of poliomyelitis outbreaks in the population size exposed to the greatest risk is difficult and is subject to large error. It is suggested that an area qualifies for initial consideration for community prophylaxis only if it achieves a rate of 40 per 100,000 within a period of not more than 1 or 2 months and has a sharply rising weekly incidence, calculated by dates of onset at the time the selection is made. Other factors useful in selecting epidemic areas are high paralytic rates with relatively increased percentages of respirator cases and deaths. Urban populations exceeding 100,000 will seldom achieve rates justifying mass prophylaxis and populations of less than 15,000 are unlikely to have enough cases, after recognition of epidemic incidence, to make this type of prophylaxis profitable. Areas most likely to qualify are those with predominantly urban populations of 15,000–100,000. In addition to these, camps, schools, and other captive populations are favorable situations for community prophylaxis.

It should be remembered that only 60–70 percent of the expected cases will be influenced, because the rates among older persons are unlikely to be high enough to justify inclusion of all ages in the treated group. It must also be remembered that, if the recommended dose is used, only a 5- to 8-week segment of the epidemic will be affected. In a few instances, it may be necessary to consider a second injection in the course of an outbreak.

Consideration must also be given to the administrative problems involved in the setting up and staffing of clinics and in the administration of gamma globulin to large numbers of children in a short period of time. The viscosity of the solution and the need for large numbers of 10 cc. and 20 cc. syringes present problems.

It is anticipated that the selection of areas and age groups for community prophylaxis will be made by the State health officer or the State allocation authority. If a request for a special allocation be made to the National Allocation Office, the State health officer will be expected to supply information on the case incidence by week of onset, the number of deaths and of respirator cases, and the ratio of paralytic to total reported cases in the area.

### *Household Contacts of Clinically Diagnosed Cases*

During epidemics, the incidence of secondary cases in families is five to twenty times the rate of poliomyelitis in the general population. That is to say, the members of a family in which a case occurs are subject to a much higher risk than are individuals in the community at large. On the basis of risk alone there would appear to be good reason to give priority to the prophylaxis of family contacts. There are, however, no controlled studies of the effectiveness of gamma globulin in the protection of household contacts of diagnosed cases. There is much evidence to indicate that infection is often widespread in families at the time the first case is recognized. If gamma globulin were effective only when given prior to infection, the case for household prophylaxis would be prejudiced. Hammon's results suggest, however, that inoculation after infection but prior to the onset of symptoms may be expected to modify the disease although it may not prevent it. This view bears significantly on the interpretation of the data in the table in which the incidence and chronological distribution of secondary cases of poliomyelitis in families are summarized.

It will be observed that 60 percent of secondary cases occur within 5 days of the diagnosis of the first case. Even if gamma globulin is

administered promptly to the household contacts, it will not be expected to prevent or modify the severity of disease in these cases. An additional 30 percent of the secondary cases will occur within a few days of inoculation. Hammon's results suggest that this group of cases may be mitigated in severity.

**Table 1. Chronological distribution of poliomyelitis cases in families following index case**

[A summary of data from several sources (*6*)]

| Days interval between onset of first and subsequent cases | Number of secondary cases | Percent | Possible prophylaxis |
|---|---|---|---|
| 0–5 | 242 | 60. 0 | None. |
| 6–12 | 120 | 29. 6 | Modification. |
| 13–30 | 42 | 10. 4 | Prophylaxis. |
| Total | 404 | 100. 0 | |

The final 10 percent of secondary cases will occur in the period in which the protective effect of gamma globulin is maximal and it is this fraction of cases that one may hope to prevent by the use of household prophylaxis. This would, at first sight, appear to be a poor return on the investment were it not a fact that the rates for this small fraction of delayed cases are comparable with the rates among all children in epidemic areas. On this basis, household prophylaxis may be expected to be as effective (cases prevented per 1,000 doses of gamma globulin) as community prophylaxis in the prevention of epidemic poliomyelitis and may be more effective if weight is given to modification as well as prevention of the disease. In areas in which epidemic proportions have not been attained, there will be no justification for general community prophylaxis.

There are a number of administrative advantages associated with household prophylaxis. The population that is to receive gamma globulin is easily defined. Distribution can be carried out through established public health channels and can be made in advance of the poliomyelitis season because allocations do not depend on the precarious prediction of epidemic incidence. Moreover, the cooperation of private physicians is assured since on them will rest the responsibility for the diagnosis of cases, and the identification and inoculation of contacts.

There is one subjective disadvantage which should not be overlooked. Some 60 percent of secondary family cases will be neither prevented nor modified by the use of gamma globulin. Unless physicians and the public are fully informed of this situation, an unjustifiably critical attitude toward the value of gamma globulin may develop. The public will see the failures of prophylaxis; the successes will be hidden from it.

*Intimate Contacts of Clinically Diagnosed Cases*

This is simply an extension of household prophylaxis to include individuals who are judged to have been as intimately associated with the diagnosed case as were the members of the household. The extension is logical but raises the difficulty of defining the criteria of intimacy. The method is likely to be most useful in rural and in self-contained suburban communities in which the number of intimate contacts of an individual is limited.

The extension of prophylaxis from household contacts to equally intimate contacts must be used with restraint; otherwise, the allocations to States will be rapidly depleted. It is anticipated that the responsibility for the definition of extra-household contacts and the areas within the State in which this method of prophylaxis may be used to advantage will rest with the State health officer.

*Household Contacts of Suspected Cases*

The immunization of household contacts of suspected cases may be viewed as a selective form of community prophylaxis which is specifically directed toward those individuals in the community subject to the most intimate exposure to the virus of poliomyelitis at the time that prophylaxis is undertaken. The use of this method is advocated only in intense epidemic situations. It may be particularly valuable in sparsely populated areas in which sporadic cases lead to extremely high rates of incidence but which are not suited to mass prophylaxis.

The method has the merit of giving protection to individuals who may be exposed to infection several days earlier than would be possible were the injections delayed until the phy-

sician could make a more certain diagnosis. There is a further hypothetical advantage which is of quite undetermined value although it may be most significant. Infection with the poliomyelitis virus is much more likely to be abortive than paralytic. It follows that the first invasion of a family by the virus is probably evidenced only by a case of minor illness. Should the case actually be one of poliomyelitis, immunization of the family at this time may prevent any paralytic case from developing.

The prophylaxis of contacts of suspected cases has serious disadvantages. Its efficacy is just as dependent as is that of community prophylaxis on the accurate prediction of epidemic conditions. If it is used in other than epidemic areas, much gamma globulin will be squandered on contacts of minor illnesses, a negligible proportion of which are poliomyelitis infections.

The method has been described as a selective form of community prophylaxis. It differs in that the office of every physician in the area will become a prophylactic clinic. From one point of view, this will simplify administration by avoiding the problems that are associated with the organization of centralized clinics. On the other hand, if a significant fraction of the total population in the area is involved, it may overtax the physicians and result in undesirable delay in completing the required number of injections.


## Summary

It is estimated that about 1,000,000 average doses of gamma globulin will be available for the prophylaxis of poliomyelitis during 1953. The selection of the group of individuals in which this limited supply of material can be used most effectively presents many epidemiological and administrative problems. Four alternative methods have been recommended by the division of medical sciences, National Research Council, and have been incorporated in the allocation plan adopted by the Office of Defense Mobilization. The advantages and disadvantages of these methods in particular situations are reviewed. The allocation plan is based on the principle that it is the local health officer who is in the best position to decide which method of prophylaxis will most effectively meet each local situation as it arises.


The household contact plan would appear to be the most effective in areas of low or moderate incidence, with possible extension to include intimate contacts other than family members. With high epidemic incidence in a community with an intense outbreak, either community prophylaxis of age groups particularly susceptible or extension of the household contact plan to include contacts of suspected cases may be suitable. Factors such as community size, expected severity and duration of the epidemic, facilities for the injection of large numbers of individuals and the availability of gamma globulin may influence the decision as to the plan for emphasis in a particular area.

The plans are of sufficient latitude, however, to apply to almost any situation, and appear to offer some hope of restricting the use of the scarce material to the groups at greatest risk.

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# Plan for the Allocation of Gamma Globulin

issued April 15, 1953, by the Office of Defense Mobilization
in the Executive Office of the President

### Packaging

Gamma globulin for the prophylaxis of measles and infectious hepatitis shall be packaged in 2 cc. vials.

Gamma globulin for the prophylaxis of poliomyelitis shall be packaged in 10 cc. vials.

### Allocation for Measles and Infectious Hepatitis

The States and Territories shall be allocated prophylactic doses of gamma globulin not to exceed 1.5 times the number of cases represented by the 5-year (1947–1951) median for measles; *except* that the allocation to any State or Territory shall not be less than the mean annual distribution of Red Cross gamma globulin during the 5-year period, fiscal years 1948–52.

The reported incidence of measles in the States and Territories shall be reviewed at monthly intervals, and supplementary allocations may be made on the basis of unusual measles morbidity.

### Allocation for Poliomyelitis

Approximately 57 percent of the total supply of gamma globulin estimated to be available for the prophylaxis of poliomyelitis shall be distributed to State and Territorial health departments in a predetermined fashion based on their past and current experience with poliomyelitis. A reserve of approximately 33 percent shall be retained by the national allocating authority for mass community prophylaxis. An additional contingency reserve of ten (10) percent shall be retained by the national allocating authority for unusual or special situations for emergency distribution and for special investigations.

The State or Territorial health officer shall have full responsibility for the distribution of the gamma globulin allocated to him. He shall decide the modes of prophylaxis which are most appropriate for use within his jurisdiction.

Allocation of gamma globulin shall be made as follows:

*Basic Allocation.* Prior to May 1, 1953, each State and Territory shall receive an allocation which shall be computed as the product of 60 cc. and the average of the number of cases reported annually in the State or Territory for the 5-year period, 1947–1951.

*Additional Allocation.* After May 1, States and Territories shall receive, at appropriate intervals, additional allocations of 60 cc. for each reported case in excess of the mean cumulative annual incidence for the same seasonal period. (States have been requested to report current experience in terms of paralytic and nonparalytic cases. It may be necessary to make adjustments in these additional allocations to individual States, depending upon the proportion of paralytic cases reported.)

*Supplementary Allocation.* About July 1 and at biweekly intervals thereafter until October 1, supplementary allocations will be made to States or Territories; these allocations will be in proportion to the typical seasonal incidence of poliomyelitis in the

United States for the period following the allocation at a level designed to distribute the supply available for this purpose to the States by October 1. The allocations to the States and Territories will be proportional to the morbidity then being reported in each State.

*Allocation for Mass Community Prophylaxis.* Special allocations from the reserve retained by the national allocating authority for mass prophylaxis shall be available on application. Applications for such special allocation shall be made by the State or Territorial health officer to the national allocating authority.

### Criteria for Use

The following methods are suggested for the use of gamma globulin in the prophylaxis of poliomyelitis. The choice of the method or combination of methods to be used will vary with the incidence of the disease and with other factors within the local area. The dose recommended, irrespective of the method used, is 0.14 cc. per pound of body weight which is believed to be the minimal effective dose.

*Mass Community Prophylaxis.* Expert opinion is in agreement that there is direct proof of the effectiveness of gamma globulin in the prophylaxis of poliomyelitis when used during epidemics on a community basis in child populations of an age group at unusually high risk. Mass community prophylaxis will be effective in direct proportion to the height of the attack rate that occurs in the first to fifth week following mass inoculation. Such rates are not easily predictable under many circumstances; they almost never occur in populations over 100,000 and rarely in populations over 50,000. In small populations under 15,000, the epidemic may be over before its existence is appreciated.

*Household Contacts of Clinically Diagnosed Cases.* There is also substantial scientific evidence that gamma globulin, when given within 1 week before the onset of disease, will modify the severity of the attack. It may be assumed that many of these individuals with modified disease were infected prior to the injection of gamma globulin. These findings are interpreted as evidence that gamma globulin, if administered to the apparently normal household contacts of clinically diagnosed cases immediately following diagnosis, may afford effective prophylaxis or modification to many. Therefore, it is recommended that gamma globulin be made available for administration to household contacts of cases. In conjunction with such use, studies should be encouraged with the objective of obtaining more specific evidence of the effectiveness of gamma globulin used in this way.

When used for the prophylaxis of contacts of clinically diagnosed cases of poliomyelitis, the following criteria are recommended:

Household contacts 30 years of age or under.
Pregnant women of any age.

*Other Intimate Contacts of Clinically Diagnosed Cases.* The inoculation of other intimate contacts will require great care if it is to be an effective method of utilization. Its greatest value is visualized in rural communities and small discrete and well defined suburban communities where the total number of intimate extra-household contacts is limited. Areas where this method is to be used should be certified by local allocation authorities after careful consideration of the circumstances. The method automatically becomes closely similar to a small mass community prophylaxis program. The danger in the method is the risk that too large a demand for the gamma globulin will be built up so that the equitable supply to the area is exhausted. Special procedures for distributing the gamma globulin to the physician in the area will have to be set up. Health officers are cautioned in the use of this method, but it is recommended that they be permitted to use it in a carefully controlled fashion, in limited areas where local conditions adequately justify the procedure.

*Household Contacts of Suspected Cases.* It is recognized that certain areas with high epidemic potentialities will not be found satisfactory for the mass injection of all children. A compromise plan might then be substituted.

During a severe epidemic there is a possibility that suspect cases, rather than confirmed cases, would serve as guides to some of the children most likely to have been very recently exposed or currently undergoing exposure. Injection of these children may have a selected advantage since some of these suspect cases will represent true primary infections in families and the whole train of possible subsequent paralytic cases occurring after the span of one incubation period would be prevented. Based on cases prevented to thousands of injections given this method may have some advantage. On this basis, this method can in no way be considered less effective per dose given than injection of all children at one specific time.

#### Distribution Within the State or Territory

While it is recognized that the exact method of distribution will vary within the States and Territories, it is recommended that:

Private physician should request gamma globulin from the local health department or other health authority.

It is further recommended that in order to obtain gamma globulin for prophylaxis, physicians should be required to furnish the name and date of onset of the case, as well as the names, ages, and weights of household contacts to be inoculated.

It is also recommended that the basic allocation of 60 cc. per case reported (p. 666, col. 2, l. 12–30) be interpreted to indicate the average amount needed for prophylaxis of household contacts of clinically diagnosed cases. The actual amount distributed to the physician for this purpose will vary depending on the number and ages of the household contacts involved.

#### Public Education

It is recommended that:

In a coordinated program of public education, the Office of Defense Mobilization make widely known such details of the allocation plan as it may see fit to adopt and implement.

If desired by the Office of Defense Mobilization, the Panel on Allocation of Gamma Globulin shall undertake further consideration of a plan for public education both lay and professional.

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## Current Readings on Gamma Globulin and Poliomyelitis

**Evaluation of Red Cross Gamma Globulin as a Prophylactic Agent for Poliomyelitis. IV. Final Reports of Results Based on Clinical Diagnosis.**
By William McD. Hammond, M.D., Dr. P. H.; Lewis L. Coriell, Ph.D., M.D.; Paul F. Wehrle, M.D.; and Joseph Stokes, Jr., M.D.
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**Gamma Globulin—What Is It? What Does It Do?**
By Sam T. Gibson, M.D.
In *The American Journal of Nursing*, volume 53, pp. 700–703, June 1953.

**Four Phases of the Polio Problem:**
**1. Michael Reese Hospital's Over-all Plan.**
By Morris H. Kreeger, M.D.

**2. Medical Management of Bulbar Cases.**
By James A. Downing, M.D.

**3. The Nurse's First Job; Establish Confidence.**
By Jacquelyn Cook.

**4. Make Room for Physical Therapy.**
By Lorette Sullivan.
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**Hospital Service During a Poliomyelitis Epidemic.**
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**Methods of Predicting Total Cases of Poliomyelitis During Epidemic Periods.**
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# Progress in Research on Poliomyelitis

By HARRY M. WEAVER

The "journey into the unknown" of poliomyelitis is traced from before 1938 to the present—and projected into the future—by one who has been along much of the journey.

RESEARCH is primarily and essentially a journey into the unknown, for the principal purpose of solving problems that disturb us, and for which we have no satisfactory solution. Prerequisite to the solving of any problem is the exploration, study, and understanding of all those areas of knowledge that are related directly or indirectly to the problem which has been posed. Without the benefit of the perspective that comes with such knowledge, one encounters the grave risk of deciding, prematurely, that a problem has been solved, only to learn to his sorrow, at some future date, that all of the relevant facts were not at hand.

Although great forward strides have been made in the general field of the medical sciences, far more remains to be learned than is known today. I am inclined, therefore, to be somewhat hesitant in drawing sweeping conclusions relating to poliomyelitis, because, it seems to me, the many voids in our knowledge of the medical sciences leave us without the depth of perspective we should have.

*Dr. Weaver is director of research for the National Foundation for Infantile Paralysis. Before taking this post in 1946 he was on the faculty of the College of Medicine, Wayne University.*

*This informal review of research, here somewhat condensed, was presented at a special meeting of the Board of Trustees of the Foundation in New York City on January 26, 1953. In his talk, Dr. Weaver pointed to limitations of time and space, remarking his "regret that it has been necessary to omit many very interesting and several potentially important observations."*

### Limitations and Scope

It is impossible for any one individual totally to comprehend the program of research against poliomyelitis. Seldom has there been assembled such an array of talent, representing so many diverse fields of scientific specialization, all working toward a single common objective. The intensity with which the individual members of this coordinated team carry out their work results in an ever growing and ever changing body of knowledge about poliomyelitis. No sooner does one investigator tentatively suggest a concept to explain some unresolved problem, than we find one or more other workers subjecting that concept to the acid test of quantitative experimentation. This constantly changing body of knowledge causes no little confusion in the minds of those persons who attempt to keep abreast of this progress. But, because this program of research is dynamic, our knowledge about poliomyelitis is approaching with unusual directness and rapidity the objective for which we all strive, i. e., the absolute and total truth.

Because of the fact that we are conducting research on so many different aspects of poliomyelitis—the virus, its host, the acute disease, its after-effects, methods of prevention and of treatment—it is difficult for any one individual to stay abreast of even the basic principles, and it is impossible for him to comprehend totally

the inferences and subtleties of this rapidly changing body of knowledge.

Finally, because poliomyelitis so frequently results in crippling, because this disease selectively affects most commonly the healthy child in the very bloom of his youth, because poliomyelitis is prone to strike with such dramatic suddenness, we are understandably anxious to rid ourselves of the dread that this affliction will strike down one of those dear to our own hearts. It is only natural, therefore, that into any report on research we try to read a new cure, a new preventive, or, at least, a new means of ameliorating the crippling after-effects of this affliction.

## A Review of Progress

My intention is not to state or imply that the means are now at hand whereby we can protect ourselves from the paralytic consequences of an infection with the virus of poliomyelitis, but rather to review, within the limitations to which I have already referred, the very considerable progress that has been and is being made in an effort to provide some practical means to control this disease. We may examine the results of research in the field of poliomyelitis in relation to four different periods of time: (*a*) prior to 1938, (*b*) from 1938 through 1947, (*c*) from 1948 through 1952, and (*d*) the years that lie ahead.

As we discuss the research of prior years, we should not lose sight of the fact that in all fields of human activities—and the medical sciences are no exception—hindsight, as compared with foresight, is very much more penetrating, illuminating, and satisfying. In assessing the work of prior years, we have available a vast body of scientific knowledge that simply did not exist when that research was being conducted. And may I be the first to point out that the body of scientific knowledge, to which I have just referred, is not by any stretch of the imagination of the making of the National Foundation for Infantile Paralysis and its grantees alone. We have unhesitatingly applied to our work in poliomyelitis, where applicable, knowledge that has emerged through no effort of ours, but because some individual or group supported an investigation on some problem which seemed totally unrelated to poliomyelitis. We are fortunate that a sharing of knowledge is the accepted way of research. Indeed, it is not unlikely that when the work of the National Foundation has been completed, history may record the fact that its greatest contribution was not the bringing forth of some practical means to control poliomyelitis, but that it stimulated and supported a cooperative effort of many scientists, from which effort emerged the knowledge requisite to fashioning the answer to one of man's even more distressing problems.

## The Years Before 1938

The National Foundation for Infantile Paralysis was created in 1938 for the purpose of initiating and supporting a comprehensive effort by scientists to develop some practical means whereby man could protect himself from the paralytic consequences of an infection with the virus of poliomyelitis. That was, and continues to be, the principal objective of this organization.

It is very difficult to describe accurately our knowledge of poliomyelitis as it existed in 1938. Research on any subject progresses in an orderly fashion through several sequential stages, of which the principal ones are: (*a*) the construction, on purely theoretical grounds, of a concept to explain one or more aspects of the problem; (*b*) the modification of the concept in accordance with what are believed to be all of the facts relating to the problem; and (*c*) the evaluation of the concept by controlled and critical experimentation.

### *Facts and Misconceptions*

The scientific literature, prior to 1938, contains many statements about poliomyelitis that have subsequently been proven to be true. This literature also contains a vast array of misconceptions. It is not too unfair to say that, for the most part, knowledge about poliomyelitis in 1938 was so limited in extent, and so lacking in experimental proof, that it was difficult for the investigator of that day to distinguish between fiction, wishful thinking, and fact.

In 1938, the science of virology was in its swaddling clothes. Only a handful of workers

were qualified by training and experience to conduct critical investigations in this field. The tools required to carry out scientific research on poliomyelitis were, for the most part, crude prototypes of those available today; and even they were in such short supply, and so expensive, that it was a fortunate worker indeed who had an opportunity to work with them. Furthermore, most work on poliomyelitis required use of monkeys, with the result that research was even further limited to those very few individuals who could obtain financial support in large amounts. In an attempt to continue work without adequate means of support, it appeared necessary to carry out with one or two monkeys experiments that should never have been attempted without utilizing scores of these animals. The result was a long period of confusion with respect to the immunology and other aspects of poliomyelitis.

### *Foundation Stones*

However, the work on this disease prior to 1938 was by no means all bad, as may have unintentionally been implied. It is a matter of record that there were laid the foundation stones of the program of research that exists today. The significant contributions of that period include: (*a*) a reasonably comprehensive description of the clinical disease; (*b*) proof that this disease is caused by a virus; (*c*) finding of an animal host, the monkey, suitable for experimental studies with the virus; (*d*) the demonstration that the crippling after-effects of poliomyelitis occur only as an aftermath of damage or destruction of nerve cells by the virus; and (*e*) suggestive evidence that the virus may be transmitted from person to person without the assistance of an extrahuman vector.

The more serious of the misconceptions that we inherited, and with which we subsequently had to deal, included the belief that (*a*) the disease is caused by only one type of virus; (*b*) the virus is capable of reproducing itself only within nerve cells; and (*c*) the virus enters the body through the nose, and subsequently travels through the body exclusively within nerve fibers. These particular misconceptions are referred to because they tended to fix the direction of research.

## The Period 1938–47

The results of research from 1938 through 1947 are difficult to describe. One of the more important accomplishments of the period was the training of additional workers and the organization of properly equipped laboratories so that a truly comprehensive and effective program of research against poliomyelitis could be instituted.

In that era we began to find out exactly what happened in the body following an infection with the virus of poliomyelitis. We learned that when disease did occur following exposure to the virus, the manifestations of disease might extend from a slight and transient fever on the one hand, to paralysis and death on the other. We learned, also, that an individual could become infected without exhibiting the slightest evidence of disease. We learned, in fact, that a "silent infection" with the virus is the rule, and that paralysis is the rare exception.

We discovered also that the digestive tract of man constitutes both the portal of entry and the portal of exit of the virus. Moreover, human beings constitute the principal reservoir of the virus in nature. We learned also that the order of frequency with which individuals may be found to be excreting the virus may be listed as: (*a*) the individual with acute poliomyelitis, (*b*) household associates of the case, and (*c*) close, personal, extrahousehold associates of the family. We determined also, as one would logically expect, that the virus could be recovered in nature from those species of flies that feed and breed on human excreta. Admittedly, we were disappointed to learn that fly abatement programs did not modify epidemics of this disease.

During that same period of time, we learned that in relatively unsanitary parts of the world where it is rather easy to isolate regularly the virus in close proximity to human beings, paralytic poliomyelitis occurs much less frequently, usually in children under 5 years, and almost never in epidemic form. Comparing such regions with other parts of the world where modern sanitation is the rule, and where one seldom isolates the virus in nature except during the time of an epidemic, we find that the paralytic disease is more common, the disease is more

likely to afflict older persons, and epidemics are the rule rather than the exception. Thus, we have the paradox of more paralytic disease in those parts of the world where there is less virus, and a lesser incidence where virus is more regularly found.

A closer scrutiny of this seeming paradox revealed the interesting fact that individuals living in those unsanitary—but nevertheless relatively poliomyelitis-free—parts of the world almost invariably had poliomyelitis antibodies in their blood. Furthermore, they acquired these antibodies at a far earlier age than in other parts of the world. The finding that a mixture of antibody and virus was incapable of causing disease suggested that antibodies might play a useful role in the body's defense against paralytic poliomyelitis. However, an attempt to utilize this observation to fashion a useful agent against paralytic poliomyelitis had to await the next era of research.

### *Advances in Treatment*

The period 1938 through 1947 was also one in which great strides were made in developing more effective treatments for individuals afflicted with the disease. While it is true that no existing form of treatment has been shown to be capable of limiting the spread of the paralytic process, methods have been devised which, if correctly employed and instituted early enough, are most effective in preventing contractures of muscles. In prior years, it was the progressive contracture of muscles that brought about the horribly misshapen bodies so frequently encountered as a result of poliomyelitis.

This same era witnessed the rapid development of methods of treatment which, although incapable of curing paralysis, enabled the afflicted individual to utilize to the fullest extent possible the motor nerve cells which had escaped destruction by the virus. During that same period we began to develop more effective methods of treatment for those unfortunate individuals suffering from respiratory paralysis.

### *Influences on Severity*

It was during this era that we learned for the first time that certain factors influence the severity of the paralytic consequences of poliomyelitis. For example, it was discovered that paralysis is more extensive and severe in those afflicted individuals who continued exhaustive physical activity during the febrile state of the disease, and that an individual is especially prone to develop the bulbar form of the disease if he contracts poliomyelitis within 30 days after removal of his tonsils and adenoids. Unquestionably a few individuals escaped the more serious consequences of poliomyelitis by taking cognizance of these observations; but the number of individuals spared must have been pitifully small. It was also observed that the incidence of paralysis is increased during pregnancy.

Paradoxical as it may seem, we also learned much when it seemed that we were learning little. We tried to circumvent many of the difficulties inherent in poliomyelitis research by attempting to unlock the secrets of poliomyelitis through work with other viruses for which simple laboratory methods were available. Although we learned a great deal about subjects other than poliomyelitis, it soon developed that the indirect approach left much to be desired. As we view that period in retrospect, it becomes painfully evident that we compounded, all too frequently, the most glaring error of the previous era—that of conducting research with inadequate numbers of animals. Again it had to be learned that conclusions drawn from improperly conceived and inadequately controlled experiments, far from contributing to progress, are apt to so confuse the issue that a practical solution to the primary problem may become buried under a mound of misinformation.

### *Lessons of a Decade*

Thus ended another era, comprising 10 years of work. More investigators had been trained, laboratories had been organized and equipped, many experiments had been performed—experiments which had yielded a very considerable body of knowledge; but, we had failed to enunciate, on even the most tentative basis, any method for control of paralytic poliomyelitis that was worthy of critical trial.

As that period drew to a close, it became evident that, if real progress were to be made, more exact methods of research would have to be instituted, objectives would have to be clearly defined, procedures and techniques would have

to be developed to permit attaining these objectives, and individual groups of workers would have to concentrate their energies on one, or at most a very few, of the objectives.

### The 1948–52 Era

During the period 1948 through 1952, the National Foundation for Infantile Paralysis instituted a policy of holding frequent informal conferences with small groups of its grantees. These "off the record" conferences provided an opportunity to critically evaluate, on a continuing basis, the status of the various research problems relating to poliomyelitis. It was in these meetings that the deficiencies in our program of research became obvious. It was here that objectives were defined, experiments designed, and workers found who were eager to devote their undivided attention, if need be, to carry out the experiments required to attain the objectives set by the group.

Reliance on group thinking to guide research can be, from an administrative point of view, a disappointing experience. However, if those concerned are principally motivated to achieve success in the total program; if the individual contributors are allowed the right to range without penalty along lines that may be ahead or even contrary to the thinking of the group; and if the conferences can be conducted in a spirit totally divorced from any employer-employee relationship—under these conditions, the effectiveness of group thinking is a stimulating experience to behold.

Credit for much of the progress in this period should be given to the many individuals who, without personal recognition, so generously contributed their thinking and suggestions to other investigators. The ingenuity, the quality, and the decisiveness of many of the recent reports on poliomyelitis reflect the effectiveness of this coordinated thinking and planning.

One of the first recommendations to come out of these conferences was that exact methods of research must be the rule. This meant fewer experiments per year, though at a vastly increased cost per experiment.

So that adequate numbers of monkeys would be available for such experimentation, and to assure delivery of uniform animals to each of the various laboratories so that the work of one could be compared with that of any other, the National Foundation established a monkey conditioning center. This center provided housing for 3,000 animals, and the supply and distribution system allowed for delivery to grantees of more than 20,000 fully conditioned monkeys annually. Without this operation many of the studies that have brought us to the point we have reached today could not have been carried out.

#### *Determination of Virus Types*

At the beginning of this era of research, we had good reason to suspect that human poliomyelitis might be caused by more than one type of this virus. Of all the problems we have undertaken to solve, none has been of greater fundamental importance than the establishment of this fact. Any hope of controlling poliomyelitis with preventive or curative drugs, preventive serums, or with vaccines; any hope of learning how the disease is transmitted from individual to individual through population groups; any hope of developing a satisfactory explanation for the fact that this disease does not affect all persons to the same extent and degree—a solution for these, and for other important problems as well—demanded that we first determine exactly how many different viruses are capable of causing human poliomyelitis. And, should more than one type of the virus be found to exist, we knew that we would then have to determine the distribution of each in nature, the capabilities of each to induce disease in the human being, and the capacities of each to induce immunity to whatever number of other types might be found.

The solution of this problem necessitated the monotonous repetition of exactly the same technical procedures on virus after virus, 7 days a week, 52 weeks a year, for 3 solid years. The number of monkeys utilized in this effort is legion. The physical effort expended by the investigators to cope with the struggles, the dodges, and the antics of this horde of primates, is almost beyond comprehension.

But, in spite of these and other difficulties, this problem has been solved. At a cost of more than $1,370,000, we have learned that there are three different types of the virus circulating

throughout all parts of the world, each capable of causing paralytic poliomyelitis in the human being. We learned also that development of immunity to any one of the virus types did not convey similar immunity to either of the two remaining types. It was also observed that within each of these types, individual strains of the virus were encountered which appeared to be less virulent than other members of the same type.

These findings stand as one of the most important milestones in research against poliomyelitis.

### *The Role of Antibodies*

Once we knew how many different viruses one had to protect against, it was possible to return to an observation that had been made prior to the era we are now discussing: The discovery that poliomyelitis antibodies are present at an early age in the blood of individuals who live in those parts of the world where paralytic poliomyelitis is seldom encountered. Such antibodies are found also in the blood of most adults, irrespective of where they might reside. These antibodies appear also in the blood of monkeys following recovery from an attack of poliomyelitis or subsequent to vaccination against the disease. There are, of course, three different poliomyelitis antibodies—one for each of the three different types of the virus.

Since these antibodies are found only in the blood of animals or human beings who seldom if ever become afflicted with the disease, and since such antibodies are capable of inactivating virus, it seemed to be of paramount importance to determine whether these antibodies are an essential link in the mechanism for protection against paralysis, or whether they represent some nonuseful byproduct of the process of infection.

There followed a number of animal experiments from which one could safely draw the conclusion that, if poliomyelitis antibodies are present in the blood in sufficient amount prior to an infection with the virus, the incidence of paralysis is materially reduced, and, under certain circumstances, may be entirely prevented. But this was the result in the laboratory, where it is possible to select the route of inoculation of the virus, and the amount and kind of both antibody and virus that are injected. Furthermore it is possible in the laboratory to administer these substances separately in accordance with a time schedule most favorable for the result desired. The next and obvious question was: Are these antibodies capable of protecting against the paralytic consequences of a natural infection with the virus in human beings?

### *Immune Serum Globulin*

Fortunately, other workers had already succeeded in their efforts to develop methods to permit extracting, in concentrated form, these antibodies which are present in the blood of most adults. This product was already in commercial production, under the name of "immune serum globulin," ordinarily referred to as gamma globulin, and had already been shown to be effective against two other viral diseases, measles and infectious hepatitis. Through the courtesy of the American National Red Cross, a very considerable quantity of this valuable material was made available.

As soon as this material could be made ready for use in the field, a Foundation grantee undertook to determine the capacity of this substance to prevent paralytic poliomyelitis in human beings. The plan for this investigation exemplifies what can be accomplished through group thinking, and its execution is a fitting tribute to those who worked so hard and skillfully toward so important an objective.

### *Results of Field Trials*

This experiment yielded two important results: (*a*) An agent which, if it could be made available in sufficient quantity, man could employ to protect himself against the paralytic consequences of a natural infection with the virus; and (*b*) a vastly more important result—the knowledge that this protection could be attributed to poliomyelitis antibodies circulating in the blood in relatively small amounts.

The field trials demonstrated quite conclusively that an injection of a sufficient quantity of this substance will confer some protection against the paralytic disease. However, the duration of effectiveness, in the dosages employed, was limited to about 6 weeks; and during the first week of this period, paralysis would appear to be lessened in severity, rather than

prevented, although the number of cases developing paralytic poliomyelitis within 1 week of an injection of gamma globulin was too small to determine for certain whether or not paralysis was ameliorated.

To further complicate this situation, immune serum globulin is obtained from the blood of human beings, and has heretofore been manufactured in rather small amounts. Because of limited manufacturing facilities and supplies of human blood, we cannot hope for the production of more than a very small fraction of the amount of this material that will be sought by the American public. A central allocation authority has been established to provide for the distribution of all of this material. This will provide a mechanism to insure, insofar as it is possible to do so, the most efficient use of this scarce product.

We are fully cognizant of the fact that immune serum globulin is not a practical answer for poliomyelitis. We knew, before the field trials were ever conducted, that when poliomyelitis antibodies are injected into the body, they disappear within a relatively short period of time. If, on the other hand, the body is induced to manufacture its own antibodies, as it does following an infection with the virus, such antibodies remain in the blood for long periods of time, perhaps for many years. The principal reasons for doing the field trials were: (*a*) to determine whether or not naturally occurring paralytic poliomyelitis is preventable by poliomyelitis antibodies; and (*b*) if so, what are the minimal amounts of these antibodies that must be circulating in the blood at the time of an infection with the virus. The results of the field trials support the concept that paralytic poliomyelitis could be prevented by vaccination, if the vaccine could induce the body to produce each of the three different poliomyelitis antibodies in sufficient amounts.

### *Significance of Tissue Culture*

But, in spite of the progress so far described, I would be very skeptical of our achieving any practical method for control of poliomyelitis within the foreseeable future were it not for yet another important discovery. This was the development of methods whereby all three types of the virus of poliomyelitis may be grown on small bits of human or animal tissues which are themselves growing in test tubes.

We have only just begun to realize the real significance of this remarkable discovery—a discovery equally applicable to a host of problems quite remote from poliomyelitis. In previous years, an investigator had no other alternative than to use large numbers of monkeys when he sought to determine whether a given material did or did not contain virus, and, if it did, in what amount and of what kind. Similarly, monkeys had to be employed to determine the amount and kind of antibody that might be present in a given sample of blood. Today, all of these experiments can be done in test tubes, and the results can be ascertained in less than one-fourth as many days as when monkeys were required.

In prior years, we could not undertake, with any reasonable hope of success, studies designed to determine the chemical and physical configuration of the virus particle. We were unable to do this because the virus could neither be obtained in sufficient quantity, nor in a simple enough menstruum, when the only source of virus was from the central nervous system tissues of monkeys. Today there is no practical limit to the amount of virus that can be produced.

Prior to the discovery of methods for growing virus in test tubes, we were without any cheap and effective laboratory procedure to sort out, from among the hundreds of thousands of chemical compounds that exist, those relatively few that might be worthy of critical trial against poliomyelitis in animals. Today, such tests are being performed in test tubes. In years past, we had far less chance than today of developing an effective vaccine. Why? Because we did not have a method that was sufficiently uniform for producing large quantities of virus; and also because viruses obtained from the nerve tissues of monkeys are contaminated with small amounts of other substances which, when injected into the body under certain conditions, are liable to precipitate destruction of the recipients' own brain tissues. It is relatively easy to standardize the growth of viruses in test tubes; and when such viruses are grown on other than nerve tissues, they are apparently free of these harmful substances.

These are not all of the practical applications that have stemmed from the development of methods for growing viruses in test tubes. But this may be enough to show why this discovery alone has, in my opinion, earned the right to be designated the keystone of modern research on poliomyelitis.

We have come to the end of the present era with a sufficient body of knowledge to know with certainty that there can be fashioned, in at least one of two ways, a practical method for control of human paralytic poliomyelitis. The first of these two methods is through use of drugs; the second is by vaccination.

### *Drug Potentialities*

There are several reasons why the first of these objectives might be a less desirable method of control. For example, drugs are usually not effective for long periods of time and, except in the face of an epidemic, it would be difficult to insure widespread use of preventive drugs on a continuing basis. Further, if there is developed a method for control of poliomyelitis with drugs capable of arresting the spread of the disease process, one would then have to recognize that in most cases the virus would have already wrought some damage before it could be brought under the influence of the drug.

Until this past year, our attempts to find an effective drug were somewhat discouraging, because we had not developed adequate experimental methods to select chemical compounds worthy of clinical trial. Now, however, the technical difficulties have in part, at least, been overcome, with the result that we are in a much more favorable position to detect reasonably effective compounds, if such compounds exist, or if they can be made.

### *Vaccination Outlook*

However, it would appear that the most likely way to develop an effective and practical method for control of human paralytic poliomyelitis would be through vaccination. With this method of control we would not have to await an outbreak of the disease, as we would if electing to control poliomyelitis through preventive or curative drugs. On the contrary, vaccination could be carried out prior to the expected appearance of the disease, with a much greater chance, therefore, of providing protection for all.

There are many different methods by which an effective vaccine might be prepared. The scientific literature shows that with serial passage of the virus through an unnatural host, the virus tends gradually to lose its capacity to invade nerve tissues and destroy nerve cells, without losing its capacity to stimulate production of protective antibodies. It now appears that one of the best procedures for producing this effect is that of growing the virus in test tube cultures of living tissues. From the theoretical point of view, vaccines prepared in this way should be the most effective of all. However, it is impossible to predict from animal experiments whether or not such preparations would be safe to use in human beings. Much laboratory work remains to be done before such vaccines can safely be administered to man. In a similar stage of development is another possible method of vaccination, in which living virus of all three types is administered following an injection of immune serum globulin. While these and other possible methods of vaccination are far from being ready for field trial, we may be assured that research will reflect increasing attention to these possibilities.

Finally, studies in both experimental animals and human beings have demonstrated that prior treatment of the virus with certain chemicals may so change the virus particle that it is incapable of damaging nerve cells but still able to induce formation of antibodies. Admittedly, a vaccine prepared in this way would have lost some of the capacity of untreated virus to elicit antibody formation. Fortunately, there is good reason to believe that the disadvantages resulting from chemical treatment of the virus can be largely overcome by administering the vaccine in conjunction with certain potentiating oils.

### *Maturation of Research*

As we examine the research that was conducted from 1948 through 1952, it becomes evident, that during this era, research on poliomyelitis attained sufficient stature to stand on its own two feet. Only a few short years ago, much of our work was done with other viruses in the rather desperate hope that in this way we would learn something about poliomyelitis for

which we did not have techniques to permit of effective study. Following full documentation of the work that has already taken place, it would not be to surprising to find other workers in the years to come using the virus of poliomyelitis in the hope that they may learn something about other pathogenic agents.

### Research of the Future

In light of recent progress, some may hope for a positive statement as to whether or not a practical method for control of human paralytic poliomyelitis is "just around the corner." Inasmuch as research is truly an exploration into the unknown in an attempt to solve a problem for which there is no presently available solution—one must reply that if we knew exactly when and by what means we could provide the solution for a particular problem, there would be no need to conduct research. As we understand the problem of poliomyelitis today, it would be unrealistic to think that a practical method for control awaits the discovery and application of some undiscovered fundamental principle or even a new technique. It would seem that we are now in possession of the scientific principles and tools required. But, although hope in the hearts of men will undoubtedly continue to spring eternal, and such hope with respect to poliomyelitis is not without some very considerable basis in fact, no one can safely predict when that longed-for day will come. The only truthful answer is this: A practical method for control of paralytic poliomyelitis will never be forthcoming unless research is continued.

It is in this present era that we have reason to expect many important forward steps will be taken. In some instances this may mean moving from work on animals to studies with human beings. Such transitions necessarily entail some calculated risk. Often it is quite impossible to determine, in advance of doing such studies, the degree of risk involved. Those who propose such steps should not be surprised if more voices are raised in opposition than in support. The investigator will be hard-pressed to distinguish between risks of reasonable probability on the one hand and risks of unlikely possibility on the other; and he must recognize that among the outcries may be those motivated by fear or due to an incomplete understanding of the problem or to an incomplete appreciation of the social responsibility of science. Perhaps the scientist contemplating such steps can gain some comfort from the provocative observation of Raymond Fosdick that "what is wrong with the world of today is not the dreams of the idealists, but the cynicism of those who call themselves realists."

### Summary

It is apparent that there has been tremendous progress in the fight against poliomyelitis, and that we are now in possession of many of the tools and basic facts with which will ultimately be fashioned a practical method for control of this affliction. It is impossible to say when this objective can be achieved, since much hard and exacting work still remains to be done. But with greater knowledge for more intelligent planning and with sharper tools for more precise experimentation, the attainment of our goal seems to be moving ever closer.

# The WHO Tuberculosis Research Office

## —*A Review of the First Four Years*—

By I-CHIN YUAN, M.D., Sc.D., and CARROLL E. PALMER, M.D., Ph.D.

AFTER the second World War, mass BCG vaccination programs were started in several countries of Europe as an emergency measure to combat tuberculosis. The work of tuberculin testing and vaccinating was conducted under the auspices of the International Tuberculosis Campaign (ITC), an organization established by three Scandinavian voluntary organizations (the Danish Red Cross, Norwegian Relief for Europe, and the Swedish Red Cross), and joined in March 1948 by the United Nations International Children's Emergency Fund (UNICEF). Through such united effort and support, the campaign was extended to millions of persons in many parts of the world. And, as this was the first time that BCG vaccination had been done internationally on such a large scale, it was not surprising that problems and questions arose for which there were no answers. The need for systematic and carefully controlled investigations of BCG vaccine and vaccination became increasingly apparent.

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At the invitation of UNICEF and ITC in the fall of 1948, a field survey was made and a report (*1*) was presented to the Joint Health Policy Committee of UNICEF/WHO on the possibilities for scientific research in connection with the mass BCG vaccination programs. The committee recommended the report to the Director-General of the World Health Organization; and the WHO members of the committee brought it to the attention of their Executive Board. As a result, the World Health Organization established the WHO Tuberculosis Research Office (TRO), in February 1949, in Copenhagen.

### Method of Investigation

The work of the WHO Tuberculosis Research Office is essentially one of applying scientific methods to technical field problems connected with the international BCG program or arising from its operations. For this, TRO has assisted and cooperated with many national and international organizations including: the Danish National Health Service, the Danish State Serum Institute, and the Danish National Anti-Tuberculosis Association; the Finnish National Anti-Tuberculosis Association; the Tuberculosis Control Service of the Icelandic Government; the Union Mission Tuberculosis Sanatorium at Madanapalle, India; the international BCG Pilot Station at Paris; the Public Health Service of the United States; the International Tuberculosis Campaign; and the WHO Tuberculosis Section which took over the work of the ITC in July 1952.

To obtain reliable results, great care is taken in the design and the execution of each investigation and in the analysis of the results. This requires appropriate statistical concepts and methods; a trained technical staff to assure uniform techniques and accurate and unbiased observations; study groups of sufficient numbers and comparable controls; and, above all, critical judgment in drawing conclusions. Such requirements are, of course, essential for scientific work, but their value cannot be overemphasized in clinical and public health research. Unfortunately, in some countries, the use of controls as a legitimate method of research in studying the treatment and prevention of disease in man is not generally accepted, either by society or by the medical profession. Any attempts of this kind are often opposed as "experimenting" on human beings. Laboratory studies on animals are fundamental to the understanding of disease processes in man. Clinical control studies, however, are essential if progress is to be made in solving many of the problems of man's health and man's diseases.

### *New Research Laboratory*

With the current extension of the WHO/UNICEF BCG program to many countries where BCG has been little used and where reliable information on the nature and prevalence of tuberculous infection and disease is lacking, the need for scientific inquiry becomes even more apparent. TRO's experiences have repeatedly shown that what is found to be true in one area frequently fails to hold as true for another area where people live under different environmental, economic, and social conditions. If serious mistakes are to be avoided in the conduct of large-scale BCG campaigns, preliminary surveys and BCG studies should be made by competent pilot teams to determine suitable techniques and criteria for vaccination and the type of results to be expected.

The Tuberculosis Research Office has hitherto put great emphasis on human field studies, although the need for basic laboratory research has been recognized for some time. A generous offer by the Danish National Health Service from their UNAC (United Nations Appeal for Children) funds together with yearly contributions from the Tuberculosis Research Office made it possible in 1952 to create an international laboratory, the Tuberculosis Immunization Research Center, where a closely coordinated program is now operating to study the complex problem of tuberculosis immunity through integration of results from both the laboratory and the field. The laboratory was established within the premises of the Danish State Serum Institute in Copenhagen by agreement between the World Health Organization and the Danish Government.

### Research Program

When the mass BCG campaign was started, the technique of tuberculin testing and vaccinating was formulated largely on the basis of experience in the Scandinavian countries, although it was recognized that changes might have to be made as the work was extended into different parts of the world. This proved to be so. Tuberculin testing procedures were repeatedly modified, and critical problems were encountered when the vaccination results were found to differ widely from what was expected. The research program developed by the Tuberculosis Research Office, therefore, involved a variety of short-term and long-range investigations which comprised almost the whole subject of BCG vaccine and vaccination from the tuberculin test to the efficacy of mass BCG vaccination in the prevention of tuberculosis. (See the outline of TRO activities, p. 680.) Its object was to place tuberculosis immunization on a rational and scientific foundation.

One of the first responsibilities that TRO agreed to undertake was to direct the collection of BCG campaign statistics and to analyze and prepare the material for publication. At the conclusion of the International Tuberculosis Campaign in June 1952, a total of 38 million children had been tuberculin-tested, and 18 million of the total had been vaccinated with BCG in 23 countries. This was the first time that mass immunization of such magnitude had been conducted on an international scale. The opportunity it offered for collection of information on tuberculin sensitivity was without precedent. The technique for the tuberculin test

## WHO Tuberculosis Research Office (TRO), Copenhagen, Outline of Activities, 1949–53

| Objectives | Operations | Results |
|---|---|---|
| **TRO STATISTICAL DOCUMENTATION OF MASS BCG CAMPAIGNS** | | |
| To assist the International Tuberculosis Campaign in organizing field statistical work and training of local statistical personnel.<br>To compile statistics and prepare reports on tuberculin testing, vaccination, and postvaccination testing of national campaigns.<br>To handle WHO/UNICEF campaign statistics after conclusion of International Tuberculosis Campaign in June 1952. | Before January 1952—statistics from 23 countries in Europe, North Africa, the Middle East, Asia, and Latin America.<br>At present—statistics from Aden Colony, Iran, Pakistan, India, Burma, Thailand, Formosa, Hong Kong, the Philippines, Malaya, Costa Rica, El Salvador, Jamaica, and Trinidad. | Annual and monthly statistical summaries for International Tuberculosis Campaign.<br>Individual reports documenting completed campaigns in 12 countries.<br>Reports for Lebanon and for Palestine refugees included in ITC second annual report (*3*).<br>Simplified procedures introduced for collection of field statistics. |
| **EVALUATION STUDIES OF BCG VACCINATION IN TUBERCULOSIS PREVENTION** | | |
| **Danish Mass Tuberculosis Campaign** | | |
| To develop national roster of the tuberculin-tested, X-rayed, and vaccinated for long-range followup of tuberculosis morbidity.<br>Special studies of relation of allergy and X-ray findings to incidence of tuberculosis. | Joint program with Danish National Health Service and Danish Anti-Tuberculosis Association for countrywide campaign in Denmark (except Copenhagen.)<br>Campaign started in early 1950 to cover 1.5 million persons aged 1–6 and 15–34 years and to include tuberculin testing, vaccination, and X-ray examination of adults. | Punch card records made for 1.2 million persons of whom half vaccinated during campaign or before.<br>Special studies conducted to evaluate and improve methods of tuberculin testing, X-ray examination, and selection of persons for vaccination.<br>Improved compulsory national notification of pulmonary tuberculosis. |
| **Finnish Mass BCG Campaign** | | |
| To study long-range effect of mass vaccination on tuberculosis mortality through national roster of the tested and vaccinated. | Cooperation with Finnish Anti-Tuberculosis Association and Finnish National Office of Vital Statistics in operating a statistical office in Helsinki and analysis of tuberculosis mortality statistics. | Work on roster begun September 1949; copying of some 1 million cards for population 1–25 years.<br>Punch cards completed for 850,000 tested and vaccinated.<br>Matching of tuberculosis death certificates against roster now progressing.<br>Steps under way to verify tuberculosis deaths for acute forms of the disease. |

was relatively uniform. Usually the test was made with a standard tuberculin produced by a single laboratory. In many countries, only a single low-dose test was used. Record forms were also standardized.

### *Statistical Documentation*

Almost all the data sent to Copenhagen have now been published in 14 reports documenting the campaigns by individual country (*2*, *3*).

## WHO Tuberculosis Research Office (TRO), Outline of Activities, 1949–53—Continued

| Objectives | Operations | Results |
|---|---|---|
| **BCG VACCINE AND VACCINATION STUDIES** | | |
| To investigate basic factors influencing allergenic potency of BCG vaccine with particular reference to problems arising in international BCG campaigns.<br>To study dosage and age of vaccine, exposure to light and heat, qualitative differences between living and dead bacilli, vaccination techniques, and so forth.<br>To compare vaccines prepared by different laboratories. | Studies chiefly in Denmark; also in Mexico, southern India, and Egypt under joint auspices of International Tuberculosis Campaign, Danish State Serum Institute, and TRO.<br>Program of testing, vaccination, and periodic retesting of school children supplemented by laboratory work at Danish State Serum Institute on vaccines used.<br>Close cooperation with national and local health services and officials, BCG production laboratories, and BCG Pilot Station in Paris. | Approximately 23,000 school children vaccinated in 27 projects.<br>Retesting after 6–12 weeks completed in all 27 projects.<br>1-year retesting completed in 20 projects.<br>2-year retesting completed in 8 projects.<br>Work in Denmark to continue on reduced scale.<br>Work in other countries being extended. |
| **LABORATORY INVESTIGATION** | | |
| To undertake laboratory research on tuberculosis immunity and immunization with particular reference to BCG. | International Tuberculosis Immunization Research Center established within premises of Danish State Serum Institute (Copenhagen).<br>Supervision and coordination by joint committee of 4 (2 each from WHO and Danish Government). | Temporary director of center appointed.<br>Bacteriologist and biochemist appointed.<br>Work begun October 1952 in newly built laboratory. |

These 14 reports describe how the campaign was conducted in each country and what tuberculin test and vaccine were used. They give detailed statistical information about tuberculin sensitivity rates in each district or county within each country. Such information has great epidemiological value for comparing tuberculin sensitivity among countries and among areas within a country. Sensitivity to a low dose of tuberculin is perhaps the best single index of tuberculosis that can be obtained for many countries today where morbidity and mortality statistics are either not available or are unreliable. Some of the reports also contain information on postvaccination retesting. During the early ITC campaigns, some retesting was done in various countries, but no conclusions could be drawn because of the variability of the methods. Since the autumn of 1950, however, specially trained teams have been sent to Ecuador, Egypt, Greece, India, and Syria to make systematic surveys of postvaccination tuberculin allergy. Analysis of the results revealed significant geographic differences, posing further problems for research.

Because tuberculosis is still the leading cause of death in almost all the Asian, East Mediterranean, and Latin American countries, a cooperative field research station has been set up in Madanapalle, India, with the assistance of the Indian Government, to study the epidemiology of tuberculosis in a rural population. The work is geographically limited in scope, but it is expected that the results will increase our understanding of the nature, prevalence, and spread of tuberculosis in a tropical region and the effect of BCG vaccination on the course and frequency of the disease. Similar epidemiological studies are also in progress in Iceland (*4*) where the insular position of the

WHO Tuberculosis Research Office (TRO), Outline of Activities, 1949–53—Continued

| Objectives | Operations | Results |
|---|---|---|
| EPIDEMIOLOGICAL STUDIES OF TUBERCULOSIS IN TWO DIFFERENT COMMUNITIES | | |
| Madanapalle | | |
| To investigate prevalence, nature, and spread of tuberculosis and to investigate certain control methods in this rural Indian community of 52,000 population, including 175 surrounding villages. | Madanapalle Field Station established through cooperation of the Indian Government and the Union Mission Tuberculosis Sanatorium at Madanapalle. | Approximately 42,000 persons tuberculin-tested and X-rayed; 11,000 of these BCG-vaccinated.<br>Retesting and X-ray reexamination of 10,000 persons in 1951–52.<br>185 patients diagnosed and treated.<br>Basic information transferred to punch cards for annual followup.<br>Analysis under way. |
| Iceland | | |
| To investigate prevalence, nature, and spread of tuberculosis and to investigate certain control methods in this insular country of 140,000 population. | Project with cooperation of Icelandic Government for countrywide studies.<br>Central office at Reykjavik. | National roster to include information on tuberculin sensitivity and X-ray findings for the population by household groupings.<br>Plans for followup of tuberculosis morbidity and mortality.<br>Detailed records for many years being transferred to punch cards. |

country and the efficient health services favor long-range followup. BCG has been used sparingly in Iceland.

Other long-range projects were designed to study the changes of tuberculosis morbidity and mortality in relation to mass BCG vaccination campaigns in Denmark (*5*) and Finland (*6*). National rosters of the tested and vaccinated have been set up in Denmark to permit direct matching of current morbidity reports and in Finland for matching of death reports. Tuberculosis morbidity or mortality of the vaccinated may thus be compared with that of the nonvaccinated (natural reactors to tuberculin) and with the expected trends in the general population.

### *Vaccination Studies*

Early in the ITC campaign, in the summer of 1948, unusually low tuberculin conversion rates were reported from one country (Poland). It was thought that possibly the potency of the vaccine had been reduced by failure to keep it cold, but several other possibilities were also considered, and it soon became clear that many questions about BCG simply could not be answered at that time. By taking advantage of the national BCG vaccination program of school children in Denmark, arrangements were made for tuberculin testing, vaccination, and followup to be conducted by special TRO research teams so as to provide answers to some of those questions. Emphasis was first placed on the effects of various physical factors, particularly temperature and duration of storage. More questions arose as the studies progressed and were extended to other countries. To date, 27 separate field research projects have been completed in which approximately 44,000 school children have been tuberculin-tested, and more

## WHO Tuberculosis Research Office (TRO), Outline of Activities, 1949–53—Continued

| Objectives | Operations | Results |
|---|---|---|
| **STUDIES OF THE TUBERCULIN TEST AND TUBERCULINS** | | |
| To study specificity of the tuberculin test with particular reference to selection of noninfected persons for vaccination in different parts of the world.<br>To investigate causes of low-grade reactions observed in tropical and subtropical countries.<br>To develop suitable methods for field standardization and comparisons of tuberculins. | Work conducted by special TRO-directed teams cooperating with national and local health authorities in Denmark, Egypt, Finland, Holland, Iceland, India, Mexico, Norway, Pakistan, and the United States of America. | In addition to the 23,000 children tested in the BCG vaccine studies, approximately 93,000 children and adults and 4,100 tuberculous patients tested with standard PPD, many with duplicate tests using varying doses and different antigens.<br>Need for further investigations of significance of different kinds of tuberculin sensitivity clearly indicated. |
| **CONSULTATION AND TRAINING** | | |
| To advise on technical matters of mass BCG vaccination previously conducted by the International Tuberculosis Campaign and now by WHO/UNICEF.<br>To assist WHO Tuberculosis Section and regional offices in training selected physicians, nurses, and statisticians for BCG work.<br>To acquaint health officers and WHO fellows from various countries with TRO work and methods of investigation. | Training by senior staff members of TRO.<br>Includes statistical evaluation projects, field vaccine studies, and cooperative research program connected with Danish tuberculosis campaign. | Increasing number of international and national officials visit WHO Tuberculosis Research Office for conferences and discussions on technical problems of BCG vaccination.<br>Requests for training of BCG personnel increasing.<br>During 1952, 36 health officers from 23 countries and 15 WHO staff members and fellows have spent from 1 day to 2–3 months in TRO. |

than 23,000 nonreactors among the 44,000 children have been vaccinated and retested at regular intervals.

The results of some of these studies have been reported in separate papers (*7*, *8*). All have recently been drawn together and published in the form of a monograph (*9*). The results have proved different in many respects from what has been generally accepted. For example, it was believed that the vaccine had to be kept cold and used within a short time after preparation, that large numbers of living organisms were needed to obtain a satisfactory allergic response, and that the potency of a vaccine could be adjusted simply by minor changes in the amount of BCG per unit volume. None of these has been confirmed. Instead, it has been shown that the vaccine can be kept for 10 weeks at 2–4° C. without significant loss of its allergenic potency; and storage at 20° C. for a month or 37° C. for 5 days causes only a slight reduction in the level of tuberculin allergic response. Vaccine could be diluted tenfold or given in twice the usual dose without causing a significant change in allergy.

On the other hand, the depth of injection of vaccine was found to have considerable practical consequence. Although the level of allergy is not affected, the size of the local lesions at the vaccination site as well as the frequency of abscesses increases with deeper injections. Differences in depth of injection may therefore

explain why a greater proportion of complications was found in some of the campaign areas than in others, even though the same vaccine was used in all of them.

### *Exposure to Light*

Although it has been common knowledge that many biological products are harmed by light and undue exposure should be avoided, the practical significance of the effect of light on BCG vaccine was not recognized until the poor results found in Egypt and other southern countries by the retesting teams prompted the search for some powerfully destructive agent. Exposure of the vaccine to sunlight was naturally suspected and a series of experiments was planned and carried out. The results showed that light has a devastating effect on the vaccine. After 30 minutes' exposure to direct sunlight, the postvaccination Mantoux reactions decreased in mean size from 20.5 mm. to 8.6 mm.; the vaccination lesions decreased in mean size from 9.0 mm. to 5.5 mm.; and the colony count of BCG organisms was reduced approximately a thousandfold. A substantial decrease in colony count was seen after exposure of the vaccine to the sun for only 5 minutes. Subsequent laboratory studies in the Danish State Serum Institute at Copenhagen have shown that exposure to ordinary daylight through the double glass laboratory windows during the preparation of vaccine also can cause a large reduction in the number of viable organisms. One of the results of the field and laboratory research is that the laboratory procedures have now been modified to avoid light exposure during the preparation and handling of the vaccine and, at the same time, WHO/UNICEF vaccination teams have been advised to take similar precautions in the field.

### *Degree of Sensitivity*

Differences have been observed among vaccines produced by different laboratories. Some workers claim that these are due to variations between strains of BCG. Field studies, on the other hand, have shown that varying proportions of living and dead organisms may account for a great deal of the observed differences. Vaccine composed entirely of dead (heat- or light-killed) organisms produces a low level of allergy, but mixtures with living organisms can produce almost any level of allergy, depending on the relative proportion of each component. Moreover, there appears to be some kind of interaction between living and dead BCG: The addition of only a small fraction of living organisms to killed vaccine produces stronger allergy than would be expected from the sum of the two acting independently.

Throughout the research program, tuberculin sensitivity—the kind induced by BCG as well as the naturally occurring kind found in unvaccinated persons—is shown to be quantitative (*10–14*). It is appropriately described in terms of degree rather than as simply being present or absent, positive or negative. After vaccination, for example, the sizes of the tuberculin reactions of a group are generally found to be fairly closely concentrated. Some reactions are smaller than the average, and some are larger, yet the population as a whole responds to vaccination with much the same degree of tuberculin sensitivity. The degree of sensitivity, in turn, depends on the particular batch or strength of vaccine used. Some vaccines induce tuberculin sensitivity as high as that found from natural infection, and the same high degree of BCG-induced sensitivity is still present after 2 years. With other vaccines the group response is of a low degree. Irrespective of the degree of sensitivity, however, the average size of the postvaccination reactions is shown to be a simple, useful way to describe results for a group of persons given the same vaccine or to compare results with different vaccines. The more familiar method of noting the percentage of positive reactions gives far less information and may even obscure large differences in the degree of sensitivity induced by different vaccines.

Tuberculin tests on some 44,000 school children in Denmark, Egypt, India, and Mexico to select those eligible for vaccination show that there are at least two kinds of naturally acquired sensitivity (*15*). One kind, strong reactions to a weak dose of tuberculin, is found everywhere. This is designated as high-grade or specific sensitivity, and it undoubtedly results from infection with virulent tubercle bacilli. Its frequency generally corresponds with the prevalence of tuberculosis. The other

kind, called low-grade or nonspecific sensitivity, is distinguished by small reactions to a weak dose of tuberculin and fairly large reactions to a strong dose. Found only in some countries, or in some areas within a country, it has no relation to the prevalence of tuberculosis (*16*, *17*). The existence of nonspecific sensitivity, even though its cause is still unknown, necessarily has a direct bearing on the validity of tuberculosis infection rates based on the combined frequency of weak- and strong-dose tuberculin reactors in some parts of the world. It also raises practical problems in how to select persons for vaccination and how to evaluate the results of mass vaccination programs.

### Future Tuberculosis Research

The work of the Tuberculosis Research Office has perhaps brought forth more questions than it has answered. It may be appropriate, therefore, to examine broadly the direction of future research to serve best the needs of international tuberculosis control programs.

Since Koch's discovery of the tubercle bacillus in 1882, repeated attempts have been made to vaccinate against tuberculosis, but the outcome of most efforts has been disappointing. The protective value of BCG in man is still a highly controversial subject. The great difficulty is that, with a few exceptions, a comparable control group of unvaccinated persons has not been used to measure the effect of BCG in the vaccinated. More control studies must be made in places where the prospect of success is good and cooperation is obtainable. In accepting responsibility for mass campaigns, we have an obligation to assess the efficacy of BCG vaccination in the control of tuberculosis.

The problem raised by the existence of a nonspecific kind of tuberculin sensitivity has far-reaching implications for all forms of tuberculosis control work. The cause of this sensitivity must be sought out and identified. At the present time, the evidence points to an infection with some sort of nonpathogenic agent or agents, possibly an acid-fast organism, which is highly prevalent in some geographic areas. Intensive research is now under way to approach the problem from different sides. Meantime, it is important that the pattern of tuberculin sensitivity be carefully studied in different parts of the world to determine where nonspecific sensitivity exists so that suitable steps can be taken to avoid overestimating tuberculosis infection rates, to modify criteria used in selecting persons for vaccination, and to evaluate postvaccination allergy more realistically.

#### *Other Areas for Research*

For practical BCG work, it is of great importance to know whether or not vaccinated individuals showing a high degree of tuberculin allergy are better protected, as some believe, than those with a low degree of allergy. This is a serious question in view of the fact that retesting surveys have revealed unusually low levels of allergy among the vaccinated populations in a number of countries. The same finding may obtain in other countries where no systematic retesting has been made or where BCG programs are being, or will be, conducted. Should individuals with allergy below a certain level be revaccinated? At the present time we do not know. The relationship between allergy and immunity is still obscure; in fact, we still know very little about immunity in tuberculosis. There are many problems to be worked out by combined laboratory and field research.

Finally, a conspicuous opportunity for medical research has arisen in connection with the intensive efforts being made against tuberculosis by international organizations. There are many countries today where tuberculosis is the leading public health problem and where reliable knowledge about the disease is lacking. It is naive to believe that orthodox measures of tuberculosis control, although they may have been effective in western Europe or in North America, are necessarily applicable in countries where conditions of life are different.

The only rational approach, perhaps also a more economical one in the end, is to combine technical assistance programs in such countries with a simultaneous program of scientific research. Undoubtedly, the same can be said about other phases of international public health work. What is practicable in one country may fail in another unless a sound basis for application has been found or the results of preliminary studies support its use. And as

international organizations are increasingly concerned with technical assistance to underdeveloped countries, the complementary role of scientific research must not be minimized.

NOTE. A selected bibliography of WHO Tuberculosis Research Office publications and other reports related to international tuberculosis research may be obtained from the authors. Copies are also available at the Tuberculosis Research Office, World Health Organization, Scherfigsvej 8, Copenhagen, Denmark.

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# "New occasions teach new duties"

Using a quotation from James Russell Lowell's The Present Crisis as his theme and title, a Harvard professor of public health practice examines pertinent changes in social and health affairs. He assesses the effects of these trends on public health as a specialty of preventive medicine.

By HUGH R. LEAVELL, M.D., Dr.P.H.

TODAY we are all shaken by a rapid succession of changes which threaten to rip us loose from the very roots of our past. These roots are so comfortable and reassuring that we tend to overlook Marcus Aurelius' advice in his Meditations to "observe always that everything is the result of a change, and get used to thinking that there is nothing Nature loves so well as to change existing forms." It is not too difficult for us to accept the idea that our business in public health is to get others to change their behavior to make for healthier living. But when we ourselves are called upon to change, the idea is less acceptable.

Two major types of changes with which public health must deal are going on in the modern world: "public" changes and "health" changes. Our professional training helps us most with the health changes. Our knowledge of biology, chemistry, and physics and their medical subspecialties helps us find and use the proper immunizing agents to prevent disease, the right kinds of food to eat, the best sprays to kill mosquitoes, and so on. We can usually adjust rather readily to rapid changes demanded as a result of research which provides better tools with which to combat health problems.

The public changes that are so important in public health work are in many respects more difficult for us to appreciate. Most of us have limited backgrounds in the basic social sciences—sociology, anthropology, psychology, economics, and political science—that might help us understand better the people with whom we must work. Yet public changes are often of even greater importance than health changes. For example, resistance to adoption of practices proven desirable by health research may completely nullify the usefulness of the research. This is illustrated by the situation in an Indian jute mill where malaria seriously hampered production. Although the mill operators provided antimalarial drugs without charge, only 15 percent of the employees took advantage of the opportunity to improve their health. Studies are now in progress by social anthropologists and physicians to learn the reasons behind this failure.

More and more we are beginning to recognize the importance of the public changes in our work and are striving to make up for our deficiencies in training in these areas of knowledge. We still have a long way to go. We also have prejudices to overcome, which tend to make us place higher values on the results of

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*This paper was presented as one of the keynote speeches at the opening session of the biennial conference of the State directors of public health nursing with the Public Health Service and the Children's Bureau, held March 9–13, 1953, in Washington, D. C.*

health research than on those of social research. This appraisal may have been justifiable in the past, but it is likely to be increasingly less so in the future. Social science is finding the scientific method quite as useful as natural science has found it.

### Health Changes

We still need to remind ourselves constantly that the increase of man's life span by 18 years in half a century has more profound medical, economic, and social implications than such developments as atomic energy, air transportation, and modern communication. Increased life expectancy at birth is giving this country a population with an increasing proportion of aged persons and is causing us to retool from programs for controlling communicable disease to plans for dealing with degenerative disease and long-term illness.

As health changes have developed, it has become possible for the preventive medicine attack to shift successively from emphasis on the environment, in the sanitation phase, to emphasis on the agents of disease, in the bacteriological phase, to emphasis on the human host, in our present stage of development.

We are also changing some of our concepts about certain diseases, and we are finding that communicable disease control and sanitation may not have entirely unmixed blessings. Ultramodern sanitation, for example, may increase susceptibility to poliomyelitis. Studies in certain African areas have indicated that a high percentage of the local population is immune to poliomyelitis, and that clinical cases of poliomyelitis are extremely rare. Presumably the people there are more or less immunizing themselves by drinking diluted sewage containing polio virus. Prevention of German measles in girls may lead to their later developing the disease as pregnant women and giving birth to children with congenital deformities. As antibiotics control bacterial diseases and more and more new viruses are found, one begins to wonder whether the viruses simply take over when the bacteria are brought under control. As more lives among prematurely born infants are saved and retrolental fibroplasia increases among those saved, one again begins to wonder a bit. Puerto Rico offers another illustration of how progress may create new problems. Following the introduction of sanitation and communicable disease control measures, the population in this island increased so rapidly as to introduce malnutrition.

These illustrations suggest that unilateral public health must give way to a multilateral approach. We must think seriously and consistently of calling in those who should be our teammates working in agriculture, industry, and education to produce better balance in program and result.

### Five Levels of Prevention

Greater knowledge of the natural history of disease opens up new possibilities for a unified attack by all members of the health team. Natural history in this sense is "the process of departure from health, beginning with the very first forces that inaugurate it in the environment or elsewhere, through the resulting changes that take place in man, and until equilibrium is reached or defect, disability, or death ensues" (*1*). Increasing knowledge of this natural history makes it possible to attack the environment, the agent, or the host at strategic points. Thus, prevention in the broad sense of the word may be achieved at five possible levels: (*a*) health promotion, (*b*) specific protection, (*c*) early recognition and prompt treatment, (*d*) disability limitation, and (*e*) rehabilitation, listed in the order in which they become applicable in the stages of the disease process.

*Health promotion* is directed not at a particular disease or disorder but toward furthering general health and well-being. Attention to nutrition during periods of growth and development and physiologic changes, encouragement of optimal personality development, application of genetic knowledge, health counseling of various types, and health education are examples of activities at this level of prevention. Involving much more than what health workers can do unaided, health promotion includes activities of educators, agricultural specialists, economists, and industrialists.

*Specific protection* intercepts the causes of disorder before they involve man. Activities at this level, which include immunization

against communicable disease, prevention of dental caries, and control of insect disease vectors, have long been characteristic of health departments and certain voluntary health agencies.

*Early recognition and prompt treatment* is effective in preventing the spread of disease to others if the disease is a communicable one; in curing or arresting the disease process if specific treatment is available; in preventing complications or sequelae; and in shortening the period of disability. Case finding in the early stages is the foundation at this level.

*Disability limitation* involves preventing or delaying the consequences of clinically advanced or noncurable disease. As our knowledge of natural history of various disease processes increases, we may anticipate less and less activity at this level of prevention, though there will obviously always be need for it in truly degenerative diseases. This and the preceding level of prevention are those at which work of private practitioners and hospitals has been largely concentrated in the past.

*Rehabilitation* is concerned with preventing complete disability and economic dependence. It may begin while the disease process continues; it becomes the major method of attack when the disease is stationary. Only recently have we begun to develop activities at this level of prevention, though in some other countries rehabilitation is in a relatively advanced stage of development.

If we keep in mind the natural history of disease and these five levels of prevention, it is apparent that there are opportunities in preventive medicine for all those in the health field, whether they be in health departments or other health agencies, private practice, or hospitals, and for workers in education, agriculture, and industry as well. Each has a part to play; each can contribute to the total attack against disease and toward the promotion of health.

Viewed in this light, public health as organized community action is a part of preventive medicine. The public health agency may be either voluntary or governmental. Private practice also plays a very important part in preventive medicine, and as preventive medicine concentrates more and more upon the host, the opportunities for private practitioners to practice broad preventive medicine increase. In the future, health departments and other health agencies will likely contribute more and more to private practitioners' work with individual patients and their families. Thus continuity of care by a single practitioner may be more possible than it has been in the past. The attitudes of people are usually favorable to those who help them in illness, and there may well be a carryover value when preventive services are tendered, making these services more acceptable.

Hospitals in the future will have a broadened concept of their place in the community, and their activities will be at all five levels of prevention. Rather than concentrating principally on early diagnosis, prompt treatment, and disability limitation, they may be expected to give increased attention to rehabilitation. As more patients are treated "vertically" rather than "horizontally," health promotion and specific protection also will be employed more widely by hospitals.

Increased knowledge of health problems has necessitated specialization. There is simply too much to know for a single individual to be an expert in all fields. Valuable though it is in many respects, this specialization makes it difficult for the layman to find his way about among the numerous specialized practitioners and health agencies.

## Public Changes

The rapid changes in social organization have necessitated such rapid adjustments as to impose severe strains on our adaptive mechanisms. A good deal of evidence indicates that these problems of adaptation have contributed materially to the increased incidence of psychosomatic disorders and mental ill health generally. The troubled political situation of the world today casts its shadow over us all. Industrialization with its mass production favors urbanization. Mechanization, even on the farm, has greatly changed living conditions. The increased leisure time now available to most of the population has created new wants as yet only poorly met. Improved living standards and full employment have lessened the old insecurities of laboring groups.

Large-scale organizations, both governmental and private, tend to create a sense of powerlessness in the individual. The individual, however, needs to participate; his capacity for participation must, therefore, be cultivated to a degree never before necessary.

An unprecedented geographic and social mobility tends to break down the ties of neighborhoods and fixed communities as well as ties with family beyond the immediate husband-wife-child complex. Children are no longer regarded as producers, but as consumers. In the small family each member tends to cherish more fully the others. There is opportunity not only for optimal physical and mental development, but knowledge of the means towards maximum personality realization is becoming more widespread. Parenthood is getting to be a profession; the child is seen more and more as a product of his home and his environment.

Equality between the sexes is being approached and many fields of endeavor are now open to women. One result of this change is that the nursing profession no longer can count upon a vast supply of recruits. Other pursuits, more remunerative and less exacting, have first call.

Social attitudes are changing, and more emphasis is being placed on the dignity and worth of the individual. This has led to diminishing discrimination and the broad acceptance of social security as a right. The period of laissez-faire economy has passed, and varying degrees of governmental control have been imposed with varying degrees of acceptance. The leveling of incomes after taxes has greatly reduced individual large-scale philanthropy, with profound effects upon voluntary agencies.

### Technical Assistance Programs

With all these changes, positive and negative in effect, economic development has proceeded at virtually a geometric rate in the United States so that this country is pulling further and further ahead of its nearest rivals. To assist in holding the free world together, an international program of technical assistance has been developed to help people in underdeveloped areas help themselves. We are finding that to do this effectively we cannot impose American ways on these people but must understand the people, their culture, and their problems.

Even in transferring strictly technical health knowledge and practices and in using modern health supplies and equipment, we must understand the basic scientific principles involved so that modification can be made to meet local needs. We must discover what are the frills and what are the essentials. Then the essentials must be made available with a minimum amount of cultural shock to the people who want help. The privy, essentially a hole in the ground, is an example. It is unimportant for its public health purpose whether the privy has a seat or whether the squatting position is used in defecation. Yet many a privy has gone unused simply because the American "sitting" model was imposed on people without taking time to discover their "squatting" habits.

The help we give does not fill a vacuum: It must replace something that is already there. As an illustration, two articles on health appeared recently on a single page of the New York Times. One related to a group of scientists, among them several Nobel prize winners, who were setting off to Asia to spread modern health knowledge. The other, taking up twice as much space, described the important place which witch doctors still play in Madagascar. These Nobel prize winners must compete with such witch doctors before they may have their own wares accepted.

In these technical assistance programs it is particularly necessary to develop teamwork between health workers and those who work in agriculture, industry, and education. Public health can be an admirable spearhead for this team since it has acceptable ends to offer, shows tangible results, and can, through training local people, make them relatively self-sufficient.

### Public Changes in Health Fields

In considering the effects of social changes in the health fields, we are beginning to see integration and coordination as answers to the problems of specialization and the need for unity of health services. Medical prepayment plans reduce the need for charity, and, if they are comprehensive, promote early diagnosis. Group

practice provides the ultimate skills of medicine in one place. Health centers enable health departments and voluntary health and welfare agencies to join in providing broad services to a neighborhood. Hospital and health department combinations make for economy and efficiency. Extension of hospital services to include home care reduces heavy hospital expenses and supplements the resources of the home. All of these services tied together in regional organizations promote smooth and economical functioning. Many different types of specialists are beginning to work together as teammates, and auxiliary workers are being recruited for less skilled jobs.

Overall health planning is receiving increased interest as manifested by the rapid growth of health councils, many of them linked with community councils in recognition of the interdependence of health and welfare services.

Through broad health education the public has new attitudes about disease. Scientific research has blossomed into a major industry, and the public is beginning to feel that research can solve all problems. Nutrition is recognized as valuable, and alcoholism is coming to be considered a disease rather than a social stigma.

As has happened in nearly all fields of science, social scientists are finding that as they become more experimental, their theoretical assumptions require rethinking. They are finding in the health field a wealth of opportunity for profitable investigation, and in many instances they are providing invaluable assistance to health workers. We cannot afford to ignore these important sources of assistance in health work. The all-important family unit, though retaining its primary functions of child-rearing, companionship, and the regulation of sexual conduct, has had split off from it some of its former economic and protective functions. It no longer performs the religious, recreational, and educational tasks that it once did. Many of these are now entrusted, to an increasing extent, to community agencies of one kind or another.

### Meaning of Changes to Public Health

What do all of these changes mean to us who work in public health?

They mean that we need a great deal more research to be able to translate the findings of biological investigation into social application. When we meet a health problem, we must recognize that two kinds of diagnosis and treatment are necessary. We must understand and deal with the health problem. We must also understand and treat the social or public part of the situation. Our pharmacopeia in both fields must be strong. It is no longer sufficient to prescribe drugs and neglect the social factors in a given case.

These changes mean that we must enlist the support of new members of the health team. "The health team cannot be a closed circle of in-facing initiates with backs to the outside world; rather, it must be an open circle ready to welcome new workers and able to expand as new areas of useful cooperation are discovered" (*2*). The place of the public health social worker is becoming obvious, and there are many important functions which the various types of social scientists can perform as health team members.

We ourselves must become real people with well-adjusted lives motivated by high purpose if we are to achieve real success. The joy that comes by doing our jobs will increase as we understand them better. A major part of this understanding will need to come to us through broader knowledge of human relations and through deeper dedication to our work. We must understand our own assignments and those of our teammates as well. Our services must be made available to the family with a minimum of friction and lost motion. Overlapping and duplicating activities can no longer be tolerated. We must seek constantly to develop arrangements which the consumer can readily understand for providing health services. If there are difficulties in administration, they must be concentrated and handled centrally. We should not expect the individual patient to deal with the maze of organizations and services the modern community provides. We must accept the responsibility, as servants of the people, of working out effectively and economically our administrative problems and the problems of agency relationships.

We must do a better job of training health workers to perform their task adequately in

international relations. Our country can no longer maintain its former ostrichlike attitude; we are not self-sufficient. Our ways are not necessarily the best ways for all people. As we work with other peoples, we must adapt ourselves and our technical knowledge to their local systems and needs. We cannot be autocratic about our democracy.

With all the changes that are in the air, we as practitioners of public health have a deep responsibility and an unprecedented opportunity to serve the people. But it is only with broadest wisdom and deepest humility that we can meet our new challenges successfully. Or in the words of Lowell:

"New occasions teach new duties; Time makes ancient good uncouth;
They must upward still, and onward, who would keep abreast of Truth; . . ."

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# A Method of Simplifying Soil Percolation Tests For Septic Tank Systems

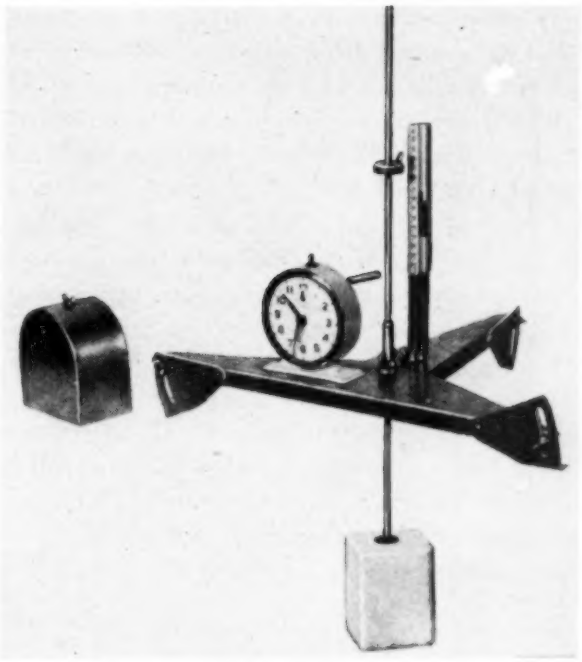
By Abraham Gelperin, M.D., Dr.P.H., and Willard O. Fuller, B.B.A.

Cities and towns are facing anew the recrudescence of an old and presumably solved problem—sewage disposal. This problem is particularly acute in fringe areas where there have been marked population growths during the past decade (*1*).

The mushrooming of new residential and industrial building beyond the limits of common sewage disposal services, both inside as well as outside corporate limits, has led to present and latent health hazards. This state of affairs is of pressing interest to health officers as well as sanitary engineers. Municipal sewage systems, with either new or expanded treatment facilities, are costly. However, long-range planning for the metropolitan area, if possible, is considered to be the least expensive and most efficient procedure (*2*). Extension of facilities street by street, as neighborhoods petition city councils, is an expediency only. For the health officer this situation entails resolving the results of inadequate past control of individual and area sewage disposal. The rules and regulations needed to insure adequate sewage disposal for the present and future must be promulgated as well. The permanent solution to the backlog of sewage disposal nuisances is extension of present common sewage disposal facilities or initiation of a sanitary district (*1–3*).

## Soil Percolation Test

But of immediate import is the approval by the health department of all buildings that require private sewage disposal, since minimum standards for private sewage disposal systems are a part of State regulations and statutes. One important aspect of this method of control, measuring the water absorption capacity of soil, continues to be a time consuming and thus a costly although necessary procedure. There is general agreement that the determination of the porosity of the soil that is to receive septic tank effluent, in conjunction with other factors such as probable sewage load, land slope, water table level, land area, and water supply, is mandatory in order to insure adequate disposal of the effluent (*4, 5*). However, the present technique of watching water seep out of a hole in the ground is frequently prohibitive in cost to many health departments, for sanitarians performing such tests cannot perform their other manifold and necessary environmental health services.



**Automatic soil percolation timer.**

It is not pertinent here to discuss the dynamics of the absorption of water by soil. However, reasonably accurate criteria for the efficient and safe disposal of septic tank effluent in a tile field have been evolved, based upon soil percolation tests and the other factors mentioned above (*4, 6*). The area of a tile absorption field is the minimum required for the probable maximum sewage load.

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Field experience has shown that soil percolation tests in one disposal field as well as in adjacent building sites may vary markedly (7). In fact, our present technique is to make at least four soil percolation tests for each field disposal area; each test hole is 8 inches wide and 27 to 30 inches deep. The results of such tests in just one Des Moines real estate development of 30 adjacent lots, requiring septic tank sewage disposal systems for 2–3 bedroom houses, illustrated the variability of soil water absorptive capacity in a relatively small area. The lots, each with a 100-foot front by 200 feet deep, were on rolling pasture land with a Webster soil as determined by a geological survey. The feet of tile required in a trench 18 inches wide by 30 inches deep is given below for the various lots.

| *Feet of tile required* | *Number of lots* | *Percent* |
|---|---|---|
| 144 (minimum) | 0 | 0 |
| 162–198 | 10 | 33 |
| 211–299 | 9 | 30 |
| 300–399 | 7 | 23 |
| 403–480 | 4 | 14 |

This is but one example which emphasizes the necessity of soil porosity tests even for adjacent building lots.

### Automatic Timing Device

A drawback to the soil percolation test, watching water seep out of a hole in the ground, has been satisfactorily solved by the use of a simple, inexpensive, automatic timing device. The instrument was constructed by our director of the bureau of environmental hygiene and has had a year of field test to date, verifying its accuracy and ease of utilization. The timers can be set up in a few minutes. The sanitarian can then leave the test fields to perform the other functions of a sanitarian. He returns in the late afternoon to pick up the timers and record the percolation times.

A total of 408 absorption fields for 2–3 bedroom houses scattered throughout Des Moines have been tested during the past year, and the following table presents our results, utilizing an automatic soil percolation timer.

| *Total time needed for 6 inches of water to percolate (minutes)* | *Number of tests* | *Average time required for percolation (hours)* | *Feet of tile required* |
|---|---|---|---|
| 24 | 0 | 0 | 144 |
| 30–60 | 126 | 95 | 162–198 |
| 66–120 | 115 | 178 | 211–293 |
| 126–240 | 88 | 264 | 300–399 |
| 246–360 | 55 | 275 | 403–480 |
| >360 | 24 | 144 | refused |
| | 408 | 956 | |

It is considered that approximately 956 man-hours have been saved by utilizing an automatic timing device, since the time required to set up the devices for the percolation tests is not appreciably longer than preparation for the tests used in present practice. We have had no problem of tampering with the device for several reasons. We know from geological survey data (7) the types of soils in the area and, roughly, their absorptive capacities. The health department program of prevention of septic tank sewage disposal malfunction has been coordinated with interested groups such as the home builders association, real estate board, master plumbers association, zoning boards, mortgage and loan associations, and public officials. Community groups have also been alerted to the available public health service. An intensive educational campaign is a mandatory requirement.

### Construction

The percolation timer, constructed of aluminum, consists of a base plate that will rest over any size percolation hole and has legs that will adjust the base to a horizontal position. On the plate is a rugged clock that fits snugly against the stops on the plate. To its rear is the trip mechanism which stops a sprocket wheel when the trigger arm is depressed. The clock has a housing to protect it from rain. The ruler post is fastened upright when in use, and the bottom of the ruler is set at the same height as the top of the trigger arm. The clock is set at noon; the float which has been inserted through the sleeve is assured of free movement by leveling the base. The round tripping ring is screwed tight at the point on the float rod opposite the top of the ruler, thus

setting the mechanism to automatically trip the trigger when 6 inches of water have been dissipated from the test hole. It is seen that the fall of any water column height can be automatically timed. The float is a cellulose compound and standard equipment as a water closet float. With this mechanism, two extra inches of water are used to compensate for water-swollen earth on the bottom of the test hole as well as the level of the float below the surface of the water column, a total of 8 inches of water. Presoaking the test holes 12 hours before the tests is a part of the routine. The reasons for this latter part of the procedure have been adequately presented elsewhere (*5*, *8*, *9*).

This automatic percolation timer permits a health department to perform accurate soil percolation tests in many more areas than possible with the present technique. It adds to the officialness and thus the acceptance of the percolation time as an important adjunct to the planning for private sewage disposal systems. And most important, the timer permits health department environmental sanitation personnel to resume other environmental health service functions.

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## Federal Food and Drug Laws Violated

The Food and Drug Administration of the U. S. Department of Health, Education, and Welfare reported 119 seizures of food and drug shipments during April 1953. All were civil actions to remove products from the market before they reached the consumer.

One permanent injunction and 27 fines against individuals and firms were also reported during April. One of the fines, $850, was imposed against an unlicensed operator of a treatment center in Kentucky. Through a "runner" in St. Louis, he supplied worthless herb medicines for out-of-State use to patients, mostly from midwestern States, whom he had diagnosed without physical examination. Several appellate courts have ruled in similar instances that the Federal Food, Drug, and Cosmetic Act is violated when misbranded medicine is offered for interstate transportation even though the "doctor" did not make the shipment.

Establishment of definite responsibility for violating the Federal food and drug laws may mean criminal prosecution for the alleged violator, the Food and Drug Administration has warned.

# 1952 Summary of Foodborne, Waterborne, and Other Disease Outbreaks

By C. C. DAUER, M.D.

IN ADDITION to reporting cases of specified notifiable diseases, State and Territorial health officers are requested to report promptly all outbreaks or unusual occurrences of communicable and other diseases of public health interest. These specifications are a part of the national morbidity reporting system which has evolved through trial and modification. Its most recent revision was unanimously approved by the Association of State and Territorial Health Officers in October 1951, effective January 1, 1952 (*1*).

### Purpose of Epidemic Reporting

The reporting of disease outbreaks is parallel and complementary to the weekly and annual reporting of cases. Whereas reporting of cases provides the data necessary to develop the incidence rates of diseases, which indicate changes in the relative magnitude of disease problems and the resources that should be allocated to control them, epidemic reporting emphasizes the circumstances of specific outbreaks. Its purpose is not so much to count every case but rather to find, through field epidemiological investigation, the sources and vehicles of infection and, if possible, the specific organism involved.

For purposes of controlling disease, it appears more important to know, for example, that the cook in a summer camp where an outbreak of typhoid fever occurred was discovered to be a typhoid carrier, or that infection was definitely traced to a polluted well, than that 20 rather than 10 cases occurred.

More specifically, investigation of foodborne outbreaks in 1952 repeatedly showed that the importance of properly storing and refrigerating food and of food handlers keeping their hands clean was not appreciated. It follows that expensive restaurant equipment and complicated licensing arrangements seem to be less significant in controlling disease than compliance with relatively simple measures. Food stored promptly in an inexpensive icebox is less likely to spoil than food placed in the most elaborate refrigerator after a few hours' exposure at room temperature. Thus the qualitative details developed in epidemic reports are essential for pointing the way to specific control measures in States and communities. Prompt reporting of unusual occurrences of disease and the circumstances surrounding them are of special importance at the present time as a defense measure against the threat of biological warfare or other catastrophe.

### Scope of the Summary

In keeping with the purposes outlined above, this report has been made as extensive as possible. It summarizes all outbreaks and unusual occurrences of disease, with specific exceptions noted below, considered important by the reporting health officers during 1952. This represents a disease base somewhat broader than was

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used in previous outbreak summaries, which were restricted to foodborne and waterborne diseases (*2*).

Some of this extension was made possible by the addition to the lists of notifiable diseases, on January 1, 1952, of certain diseases not previously reportable on a national basis. Infectious hepatitis, for example, was mentioned in only 2 or 3 reports during 1951; its addition in 1952 apparently focused attention on its widespread occurrence and led to the reporting of 27 outbreaks. This beginning makes it possible to include the disease in the present summary, though it is obvious that in view of the 17,200 individual cases reported full reporting of infectious hepatitis outbreaks was far from being achieved.

Various other diseases, such as ringworm of the scalp and rickettsialpox, which are not specifically included in the lists of those to be reported to the Public Health Service, are nevertheless reportable in many States. To the extent that such reports were forwarded, they are included in this summary for the first time.

In certain instances, information on an outbreak was first obtained from other Federal agencies. For example, a widespread outbreak of salmonellosis in infants, due to ingestion of infected dried egg yolk, was discovered by the Food and Drug Administration. This exchange of information, resulting from cooperative arrangements, is of mutual benefit to the various agencies concerned.

The outbreak of influenza B early in 1952 is not included because it has been described by the Influenza Information Center, National Institutes of Health (*3*). Although certain other diseases, notably poliomyelitis, occur in localized epidemics, they are excluded because it is not practicable to report them as outbreaks.

Details of nearly all the individual outbreaks covered in this report have appeared currently in the Communicable Disease Summary issued weekly by the National Office of Vital Statistics.

### Limitations of Reporting

The tabulation of outbreaks in the accompanying tables shows very clearly that reporting practices differ widely from State to State. The large number of outbreaks reported by some States as compared with small numbers or none at all in other States undoubtedly reflects superior reporting practices more than differences in occurrence. In many parts of the country the importance of reporting, investigating, and applying control measures to epidemic diseases is evidently not adequately understood. In some States little effort has been made to overcome the considerable time lag in reporting by physicians and local health departments. In others a vigorous promotion effort seems necessary in order to get any reports at all. This problem of overcoming the difficulties in getting unusual disease situations reported, so that investigations may be made, is of concern not only to the Public Health Service and the State health departments, but to the Food and Drug Administration and the Department of Agriculture, and to analogous agencies in State governments.

Figures on numbers of outbreaks, and particularly on numbers of cases, as shown in the tables, should therefore be regarded as indicative of conditions in States with well-developed reporting systems, rather than as a basis for interstate comparisons. Even in States with the most alert reporting systems, the exact cause of outbreaks is sometimes impossible to determine because specimens for laboratory examination cannot be obtained.

### Summary of Findings

Outbreaks of waterborne and milkborne diseases in 1952 were confined to a few States, but outbreaks in which food other than milk was the vehicle of infection occurred in all parts of the country. Faulty methods of handling food and improper storage and refrigeration continued to be found on investigation of many outbreaks. These defects were also evident in the reports of outbreaks in 1951 (*2*).

Despite progress in sanitation and other health measures, there are many persistent communicable diseases that continue to challenge health authorities. For example, staphylococcal food poisoning, salmonellosis, bacillary dysentery, and many diarrheal diseases of unknown etiology remain as common occurrences, and infectious hepatitis appears to be on the increase.

## Vehicle of Infection

### *Water*

A somewhat larger number of waterborne outbreaks of disease was reported in 1952 than in 1951, but the number of persons involved (530) was smaller in 1952.

In one outbreak, well water which became polluted as the result of a blocked sewer was the vehicle of typhoid infection; in another, a dug well supplying water to a restaurant was considered to be the source of typhoid infection. Three other outbreaks of typhoid fever were suspected of being waterborne, but definite proof was lacking.

A large outbreak of infectious hepatitis occurred among persons attending a summer camp in which spring water was shown to be polluted. Three weeks prior to the onset of the hepatitis cases, an outbreak of gastroenteritis had occurred among this group. Eight other outbreaks of undifferentiated gastroenteritis were reported in which water was considered to be the vehicle of infection. Five of these involved the use of polluted wells; one was traced to the use of raw creek water; and in another, low water pressure had permitted water fountain outlets to become contaminated.

### *Milk and Milk Products*

Comparatively few of the outbreaks reported in 1952 were traced to milk or milk products. One milkborne outbreak occurred in an institution which used raw milk produced on the premises. *Streptococcus faecalis* of the viridans group was recovered from the milk. A large epidemic of *Shigella sonnei* dysentery occurred in a school using milk from a dairy. Investigation showed that a batch of milk at this dairy was improperly pasteurized immediately preceding the outbreak, but the source of infection of the milk was not determined. In another instance, milk was only suspected of being the vehicle of infection of a group of 100 cases of gastroenteritis in a school.

Milk products were found to be vehicles of infection in only three small outbreaks of disease. One group of 5 persons became ill after eating cheese; another, of 10 persons, after eating ice cream contaminated with *Salmonella montevideo;* and the third, of 7 persons, after

**Foodborne and waterborne disease outbreaks, by vehicle of infection, reported in 1952**

| State | Water | | Milk and milk products | | Other foods | |
|---|---|---|---|---|---|---|
| | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases |
| Total | 14 | 530 | 6 | 833 | 143 | 6,828 |
| Alabama | | | | | | |
| Arizona | | | | | 1 | 5 |
| Arkansas | | | | | 4 | 360 |
| California | 2 | 14 | | | 29 | 1,248 |
| Colorado | 1 | 8 | | | 1 | 12 |
| Connecticut | | | | | 4 | 228 |
| Delaware | | | | | | |
| District of Columbia | | | | | | |
| Florida | | | | | 4 | 92 |
| Georgia | | | | | 1 | 92 |
| Idaho | | | | | | |
| Illinois | 1 | 50 | | | 2 | 47 |
| Indiana | | | | | | |
| Iowa | | | | | 2 | 20 |
| Kansas | | | | | | |
| Kentucky | | | | | 6 | 318 |
| Louisiana | | | | | 1 | 40 |
| Maine | | | 1 | 81 | | |
| Maryland | | | 1 | 7 | 3 | 103 |
| Massachusetts | | | 1 | 62 | 9 | 424 |
| Michigan | | | | | 4 | 279 |
| Minnesota | | | | | 5 | 670 |
| Mississippi | | | | | 2 | 264 |
| Missouri | | | | | 7 | 368 |
| Montana | | | | | | |
| Nebraska | | | | | | |
| Nevada | | | | | | |
| New Hampshire | | | | | | |
| New Jersey | | | | | | |
| New Mexico | | | | | | |
| New York | 8 | 232 | 1 | 39 | 30 | 1,007 |
| North Carolina | | | | | 2 | 16 |
| North Dakota | | | | | | |
| Ohio | | | | | 6 | 100 |
| Oklahoma | | | | | | |
| Oregon | | | | | 5 | 596 |
| Pennsylvania | | | | | 1 | [1] 7 |
| Rhode Island | | | | | 1 | 20 |
| South Carolina | | | | | | |
| South Dakota | | | | | 2 | 44 |
| Tennessee | 2 | 226 | 2 | 644 | 1 | 4 |
| Texas | | | | | 1 | [1] 5 |
| Utah | | | | | | |
| Vermont | | | | | | |
| Virginia | | | | | 1 | 5 |
| Washington | | | | | 1 | 120 |
| West Virginia | | | | | 3 | 110 |
| Wisconsin | | | | | | |
| Wyoming | | | | | 1 | 16 |
| Alaska | | | | | | |
| Hawaii | | | | | 3 | 208 |

[1] Reported from ship in port city.

## Foodborne, waterborne, and other disease outbreaks, by type of infection, reported in 1952

| State | Typhoid fever | | Salmonellosis | | Bacillary dysentery | | Trichinosis | | Staphylococcal food poisoning | | Gastroenteritis, type not stated | | Infectious hepatitis | | Streptococcal sore throat | | Diphtheria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases | Outbreaks | Cases |
| Total | 11 | 156 | 31 | 1,335 | 12 | 1,441 | 5 | 40 | 77 | 3,798 | 50 | 2,049 | 27 | 1,306 | 5 | 363 | 8 | 269 |
| Alabama | | | | | | | | | | | | | 2 | 59 | | | 2 | 98 |
| Arizona | | | | | | | | | 1 | 5 | | | 1 | 200 | | | | |
| Arkansas | | | | | | | | | 3 | 310 | 1 | 50 | 1 | 17 | | | | |
| California | 1 | 3 | 5 | 129 | 1 | 37 | 2 | 17 | 13 | 835 | 9 | 274 | 2 | 31 | | | | |
| Colorado | 3 | 26 | | | | | | | | | | | | | | | | |
| Connecticut | | | 1 | 70 | | | | | 3 | 158 | | | 1 | 19 | | | | |
| Delaware | | | | | | | | | | | | | | | | | | |
| District of Columbia | | | 1 | 2 | | | | | | | 2 | 5 | 2 | 8 | | | | |
| Florida | | | | | 1 | 174 | | | 4 | 92 | | | 1 | 11 | | | | |
| Georgia | 1 | 11 | | | | | | | | | 1 | 92 | | | | | | |
| Idaho | 1 | 5 | | | | | | | 1 | 29 | | | | | | | | |
| Illinois | | | 1 | 11 | | | | | | | 2 | 86 | | | | | | |
| Indiana | | | | | | | | | | | | | | | | | | |
| Iowa | | | | | | | 1 | 15 | 1 | 5 | | | | | | | | |
| Kansas | | | | | | | | | | | | | | | | | | |
| Kentucky | | | 2 | 236 | | | | | 2 | 78 | 2 | 4 | | | | | | |
| Louisiana | | | | | | | | | 1 | 40 | | | | | | | | |
| Maine | | | 1 | 3 | | | | | | | | | | | 1 | 81 | | |
| Maryland | | | 2 | 52 | | | | | 1 | 45 | 1 | 13 | | | | | 1 | 17 |
| Massachusetts | | | 6 | 336 | 1 | 36 | | | 3 | 29 | 1 | 6 | | | 2 | 144 | | |
| Michigan | | | 2 | 191 | | | | | 2 | 88 | 1 | 18 | | | | | | |
| Minnesota | 1 | 7 | | | 1 | 162 | | | 5 | 663 | | | | | | | 1 | 3 |
| Mississippi | | | 1 | 14 | | | | | | | 2 | 253 | 3 | 62 | | | | |
| Missouri | | | 1 | 103 | 1 | 152 | | | 4 | 108 | 2 | 7 | 1 | 27 | | | | |
| Montana | | | | | | | | | | | | | | | | | | |
| Nebraska | | | | | | | | | | | | | 1 | 15 | 1 | 86 | | |
| Nevada | | | | | | | | | | | | | | | | | | |
| New Hampshire | | | | | | | | | | | | | | | | | | |
| New Jersey | | | | | | | | | | | | | | | | | | |
| New Mexico | | | | | | | | | | | | | 1 | 21 | | | | |
| New York | 4 | 104 | 5 | 103 | 6 | 241 | 1 | 4 | 15 | 444 | 16 | 680 | 2 | 64 | 1 | 52 | 1 | 7 |
| North Carolina | | | | | | | | | 1 | 2 | 1 | 14 | | | | | | |
| North Dakota | | | | | | | | | | | | | | | | | | |
| Ohio | | | | | | | 1 | 4 | 5 | 96 | 1 | 3 | 1 | 33 | | | 2 | 27 |
| Oklahoma | | | | | | | | | | | | | | | | | | |
| Oregon | | | 1 | 40 | | | | | 2 | 404 | 1 | 150 | | | | | | |
| Pennsylvania | | | | | | | | | | | 1 | [1] 7 | | | | | | |
| Rhode Island | | | | | | | | | 1 | 20 | | | | | | | | |
| South Carolina | | | | | | | | | | | | | 2 | 165 | | | | |
| South Dakota | | | | | | | | | 2 | 44 | | | | | | | | |
| Tennessee | | | | | 1 | 639 | | | 1 | 4 | 2 | 127 | 1 | 104 | | | | |
| Texas | | | | | | | | | | | 1 | [1] 5 | | | | | | |
| Utah | | | 1 | 40 | | | | | | | 1 | 100 | 1 | 7 | | | | |
| Vermont | | | | | | | | | | | | | | | | | | |
| Virginia | | | | | | | | | | | 1 | 5 | | | | | | |
| Washington | | | | | | | | | 1 | 120 | | | 1 | 100 | | | | |
| West Virginia | | | 1 | 5 | | | | | 2 | 105 | | | 1 | 200 | | | | |
| Wisconsin | | | | | | | | | | | | | 1 | 7 | | | | |
| Wyoming | | | | | | | | | 1 | 16 | | | | | | | | |
| Alaska | | | | | | | | | | | | | 1 | 156 | | | 1 | 117 |
| Hawaii | | | | | | | | | 2 | 58 | 1 | 150 | | | | | | |

[1] Reported from ship in port city.

drinking eggnog from which a *Salmonella* organism was isolated.

*Poultry and Eggs*

Poultry and eggs were far more important than milk or water as sources or vehicles of infection. In 39 outbreaks, a large proportion of which were proved or suspected to be *Salmonella* infections, chicken or turkey, more often the latter, were proved or suspected to be the vehicles of infection. In a disease outbreak in a family group, eggnog was found to contain a type C *Salmonella* organism, and *Salmonella* infections in infants in many parts of the country were traced to a powdered egg yolk product. These reports very clearly indicate that fowl and eggs constitute a large reservoir of infection, and they emphasize the need for more effective measures to prevent transmission of infection to man.

*Shellfish*

Only one outbreak of 66 cases was reported in which raw shellfish were consumed. There was no definite proof of contamination of the raw clams eaten at a country club dinner, but no other source of infection for the outbreak could be found.

**Types of Infection**

*Staphyloccocal Food Poisoning*

Laboratory evidence of the presence of a staphyloccocus in food was available for 32 outbreaks of food poisoning, and epidemiological investigation indicated this type of food poisoning in 45 additional outbreaks. Of these 77 outbreaks, a cream-filled pastry was involved in 15; ham, in 21; turkey or chicken, in 10; and salads, in 10.

In 28, or approximately one-third of the 77 outbreaks, lack of or inadequate refrigeration was considered to have been a contributing factor. In 5, a food handler was found to have lesions or infections on his hand; in 3, a food handler had a throat infection; in 4, foodhandling procedures were considered unsatisfactory; and in 1, a dirty meat grinder was considered to have been the source of contamination.

These outbreaks were distributed as to place of occurrence or source as follows: schools and institutions, 26 percent; public eating places, 25 percent; banquets and picnics, 19 percent; homes, 15 percent; and following purchase of food from bakeries, 15 percent.

*Typhoid Fever*

Eleven outbreaks of typhoid fever, consisting of 152 cases, were reported from 5 States in 1952, as compared with 3 outbreaks in 1951. In four instances, carriers, not previously known, had prepared food eaten by persons who became ill. In one of these occurring in a day camp, the camp cook was discovered to be a carrier through an examination of food handlers. Water was suspected of being the vehicle of infection in two outbreaks, but bacteriological evidence was lacking. Contaminated well water was shown to be the source of infection in two other outbreaks, and the use of polluted river water was demonstrated in another. In one family outbreak, no source of infection could be found. Milk was not suspected of being the vehicle in any typhoid fever outbreak.

*Bacillary Dysentery*

One of the 12 reported outbreaks of bacillary dysentery, or shigellosis, was considered to be milkborne, but none waterborne. These outbreaks, consisting of 1,441 cases, resulted in 13 deaths. In the milkborne outbreak, consisting of 639 cases in a school, epidemiological investigation revealed that pasteurization had been improperly carried out, but the source of infection of the milk was not discovered. One outbreak of 36 cases and 12 deaths in an institution was considered to be a person-to-person type of infection. Two outbreaks were considered to have been transmitted by food other than milk—in one instance, a tuna fish salad.

In 9 of the 12 outbreaks, *Shigella sonnei* type of infection was demonstrated, and a Flexner type of *Shigella paradysenteriae* was found in the remaining 3.

*Salmonellosis*

Outbreaks of salmonellosis in 1952 were reported to have occurred under a variety of conditions, namely, in a nursery for newborn infants; following banquets, church suppers, and picnics; in institutions and schools; in a jail; in private homes; and often following eating in restaurants. In 15 outbreaks, consisting of 597 cases and 2 deaths, *Salmonella* organisms were identified as follows: *S. typhimurium*, in

7; *S. oranienburg*, *S. heidelberg*, and *S. newport*, in 1 each; and an organism in group C, in 2. Five of these outbreaks followed ingestion of turkey or chicken meat, and in one, homemade eggnog was presumed to have been contaminated by raw eggs.

Sixteen other outbreaks, involving 738 cases, were reported in which laboratory confirmation of the diagnosis was lacking. In 14 of these, turkey or chicken meat was regarded as the vehicle of infection; 1 occurred in a nursery; and in the remaining 1, barbecued beef appeared to be the vehicle.

In addition to these outbreaks, cases of salmonellosis among infants with a history of ingestion of dried egg yolk were reported from many parts of the country. Early in November it was recognized that a few cases followed the ingestion of dried egg yolk processed by a single manufacturer. The first so recognized was in the District of Columbia, and soon after suspect cases were found in New York City. Presence of *S. montevideo* was demonstrated in the stools of sick infants and in samples of certain code numbers of the egg product. All State health officers were then notified to investigate and report any cases of salmonellosis coming to their attention. Contamination of the dried egg yolk was demonstrated throughout the whole range of production, which began about the middle of 1952. Sale of the product began in July and all unsold supplies were recalled in November.

Laboratory confirmation of diagnosis was obtained in over 50 such cases in 16 States and the District of Columbia. In an additional 40 cases laboratory evidence of infection was not mentioned in the report. These *Salmonella* infections were predominantly *S. montevideo*, but *S. barielly*, *S. oranienburg*, and *S. tennessee* were also reported. Nearly all cases were reported to be mild and there were no deaths.

### *Undifferentiated Gastroenteritis*

In 50 outbreaks of disease, there was insufficient information to determine the type of infection. In 8 of these, water was considered to be the source of infection. In 1 outbreak, where creek water was used as drinking water, "a good many" cases were reported. In 2 outbreaks, 50 persons became ill after drinking water from wells, investigation of which disclosed seepage from septic tanks; and in 2 others, faulty chlorination had preceded the outbreak.

### *Trichinosis*

Five outbreaks of trichinosis were reported in 3 States. In 3 of the outbreaks, the patients had eaten partially cooked or uncooked pork, and in the fourth, 7 of 9 persons who had eaten bear meat developed symptoms 14 to 17 days after exposure. The bear meat had been in cold storage 10 days and then frozen.

### *Botulism*

Only 2 small outbreaks of botulism were reported in 1952, 1 in California and 1 in Oregon. In one, in which 3 persons were ill and 2 died, home-canned mushrooms were involved. In the other, involving 2 persons, both of whom died, home-canned beets were found to be contaminated. Both groups of cases were caused by botulinus toxin type A.

### *Streptococcal Infections*

Five outbreaks of streptococcal infection were reported, 4 of them involving 359 cases and no deaths and the fifth involving a "communitywide area." Epidemiological investigation of one group of 82 cases, which occurred in a hospital, indicated that the outbreak was foodborne, but the specific item of food was not identified. An outbreak in an institution for boys, in which 62 of 195 persons exposed developed the infection, was traced to a viridans type of streptococcus in raw milk. A group of 81 cases of streptococcal sore throat was reported among persons who had eaten warmed-over stew in a college dormitory dining room, which served about 600 persons. *Streptococcus viridans* was isolated from the purulent discharge from the thumb of a cook and from throats of the ill persons.

## Outbreaks in Military Personnel

Sixty-nine disease outbreaks were reported in various units of the armed services stationed in continental United States in 1952. A total of 3,833 persons were affected. Thirty-seven, or more than half, of these outbreaks, were classified as food poisoning. One outbreak, involving 78 persons, was identified as bacillary

dysentery. Six, involving an unknown number of persons, were shown to be *Salmonella* infections. Others were reported merely as diarrhea or gastroenteritis. None of these outbreaks are included in the data given in the accompanying tables.

## Other Disease Outbreaks

A number of disease outbreaks not attributed to food or water were also reported during 1952. These included diseases spread by person-to-person contact and those in which animals or arthropods were the source of infection.

### *Infectious Hepatitis*

Outbreaks of infectious hepatitis reported in 1952 numbered 27. The 1,306 cases in these outbreaks, however, represent only a small fraction of the 17,200 cases reported in weekly telegraphic reports. The numbers reported in the outbreaks varied from a few to 200. Several of these outbreaks occurred predominantly in school populations or among college students; 2, in summer camps; 3, in housing developments; and 2, at Indian reservations or schools. Person-to-person contact was considered to be the principal mode of transmisison. However, in one outbreak occurring on an island, nearly all persons affected were users of the same water supply. Another outbreak of 104 cases among persons attending a church camp was preceded by an epidemic of gastroenteritis. In this instance, it was clearly demonstrated by use of a dye that the spring water supply of the camp was contaminated by a leak in the sewer line from one cottage.

### *Diphtheria*

In spite of the fact that diphtheria has shown a steady decline in incidence for many years, 8 outbreaks with 269 cases and 6 deaths were reported in 5 States and Territories in 1952. One small outbreak at an Indian reservation was characterized as an occurrence of "black" diphtheria. Seven cases with two deaths occurred in an institutional outbreak. One outbreak of 64 cases was confined to a single area of a city, and another was believed to have occurred because medical services provided in the community had emphasized curative rather than preventive measures.

### *Psittacosis*

Several family outbreaks of psittacosis were reported. Two outbreaks of 3 cases each followed contact with sick parakeets in the home; another involved 2 persons. Outbreaks of the disease were also reported among workers in a poultry processing plant, and a group of three cases occurred among railway express employees who had contact with psittacine birds being shipped. Investigations indicated that pigeons and canaries were sources of infection of individual cases reported in various parts of the country.

### *Miscellaneous Diseases*

Anthrax was reported in a large number of domestic animals, mostly swine, in the north central States early in 1952. Contaminated bonemeal was found to be the vehicle of infection. Two cases in humans for whom there was a history of contact with diseased animals or with the contaminated feed, and a number of cases in animals following vaccination against the disease were also reported.

Twelve cases of tularemia occurred in a family group as the result of contact with a wild rabbit. An outbreak of rickettsialpox occurred among persons living in an apartment, investigation of which revealed large numbers of house mice and mouse mites in the vicinity of the apartment incinerator.

Other outbreaks reported included ringworm of the scalp in a group of school children, encephalitis in the central valley of California, several groups of cases in which Coxsackie virus was regarded as the probable infectious agent, a small group of malaria cases in children attending a summer camp, trachoma at an Indian reservation, and a group of cases diagnosed as primary atypical pneumonia in an institution.

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(2) Dauer, C. C.: Food and waterborne disease outbreaks—1951 summary. Pub. Health Rep. **67**: 1089–1095 (1952).

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# Protozoans in Stools Unpreserved and Preserved In PVA-Fixative

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In an earlier report (*1*), we demonstrated the effectiveness of polyvinyl alcohol (PVA) fixative in preserving the trophozoites of the intestinal amebas and recommended that it be incorporated in a two-bottle outfit for the collection of stool specimens whenever it was not possible to have them examined immediately. This method of collection is particularly applicable to public health laboratories which generally receive specimens for diagnosis through the mail. The present study compares the relative effectiveness of the PVA-fixative technique and other procedures in detecting intestinal protozoans in feces.

## Materials and Methods

Arrangements were made with the Grady Memorial Hospital in Atlanta whereby stool specimens were collected and sent to the Communicable Disease Center laboratory of the Public Health Service in Atlanta for examination. Part of each normally passed, fresh stool was immediately preserved in PVA-fixative, and a part was left unpreserved. All specimens were over 4 hours old when they reached the laboratory.

Patients submitting stools included new hospital admissions and individuals suspected of having amebic or other intestinal infections. Five hundred specimens were submitted from approximately 270 patients. Since the specimens were generally identified only by the patient's last name, it was not possible to tell in every instance whether the patient was a repeat case or a new one. For these reasons, the percentages of the parasites found in this study do not indicate infection rates of a population. They represent only what was found in 500 separate stool specimens examined by various techniques.

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## Examination

The unpreserved portions were examined by direct wet mounts (saline and iodine), modified zinc sulfate concentrations, and hematoxylin-stained direct smears, the methods for which are described in techniques 1, 2, and 3 below. The PVA-preserved portions were examined by hematoxylin-stains of PVA films, as explained in technique 4.

*Technique 1.* A fleck of feces was mixed with a drop of saline and covered with a 22 mm. square cover slip. A similar preparation was made using an iodine solution. The entire saline mount was carefully examined. The iodine mount was used to assist in identifying organisms which were found in the saline preparation.

*Technique 2.* Approximately 1 gm. of feces was mixed with tapwater in a 14 by 85 mm. test tube. The test tube was centrifuged at 2,000 r. p. m. for 1 minute. The supernatant was poured off, and the tube was refilled not quite to the top with zinc sulfate solution (specific gravity 1.18). After a second centrifugation at 2,000 r. p. m. for 1 minute, the tube was placed on a rack, and sufficient zinc sulfate solution was added with a dropper to raise the meniscus above the top of the tube. A 22 mm. square cover slip was carefully superimposed on the tube and allowed to remain undisturbed for 5 to 10 minutes. At the end of that time, the cover slip was removed, lowered onto a drop of iodine solution on a slide, and examined.

*Technique 3.* Flecks of feces were spread in thin films on two 75 by 25 mm. slides, which were immediately immersed in Schaudinn's fixative. One slide was then stained by the Tompkins-Miller rapid hematoxylin technique (*2*). When the results of this method were not criti-

cal enough, the Heidenhain iron-hematoxylin procedure was used to stain the duplicate slide.

*Technique 4.* A drop of the sediment from each portion preserved in PVA-fixative was pipetted onto two 75 by 25 mm. slides, spread over an area approximately 25 mm. square, and allowed to dry overnight in a 37° C. incubator. The two dried films were stained in the same manner as described under technique 3.

The various preparations were examined for as long as was necessary to satisfy the examiner of the diagnosis. Inasmuch as the reports of these examinations were used by the hospital in the management of the patient, some checking back and forth concerning the results of the various techniques occurred in order to confirm or deny the presence of a given organism in a patient.

### Results and Discussion

The hematoxylin-stained films of the portions preserved in PVA-fixative revealed more positives than did any one of the techniques performed on the unpreserved portions of the same specimens—146 as compared to 92 for the next most efficient procedure (table 1). It should be noted that no infections with *Dientamoeba fragilis* would have been found under the conditions of this survey if PVA-fixative had not been used. In the past, this species has been considered extremely rare. The use of a preservative like PVA-fixative should make possible a truer picture of the incidence of this form. Such information would be valuable in view of the possible pathogenic character of this organism (*3*).

*Trophozoites.* The greater efficiency of the PVA-fixative method is primarily due to its ability to preserve the trophozoites of the intestinal protozoans which in an unpreserved stool ordinarily deteriorate beyond recognition within a few hours. In this study, the PVA-fixed portion revealed 100 percent (124 of 124) of all the detected infections with trophozoites, whereas the most efficient of the procedures used on the unpreserved portions revealed only 14 percent (17 of 124) of the trophozoites (table 1).

This effectiveness of PVA-fixative in preserv-

**Table 1. Number of infections with intestinal protozoans, trophozoites, and cysts (identified or not) found in 500 stool specimens examined by 4 techniques**

| Organisms | Type of specimen and techniques used | | | | |
|---|---|---|---|---|---|
| | Unpreserved | | | Preserved in PVA-fixative | All four techniques combined |
| | (1) Direct wet mount | (2) Modified zinc sulfate concentration | (3) Hematoxylin-stained direct smear | (4) Hematoxylin-stained PVA film | |
| *Endamoeba histolytica* | 10 | 17 | 19 | 28 | 38 |
| *Endamoeba coli* | 23 | 30 | 19 | 25 | 39 |
| *Endolimax nana* | 26 | 35 | 40 | 67 | 71 |
| *Iodamoeba butschlii* | 4 | 4 | 3 | 6 | 7 |
| *Dientamoeba fragilis* | 0 | 0 | 0 | 7 | 7 |
| *Giardia lamblia* | 6 | 6 | 9 | 9 | 11 |
| *Chilomastix mesnili* | 0 | 0 | 1 | 2 | 2 |
| Small flagellates | 0 | 0 | 0 | 2 | 2 |
| Total | 69 | 92 | 91 | 146 | 178 |
| Unidentified organisms | 15 | 9 | 5 | 16 | 15 |
| Positive stool specimens | 68 | 73 | 77 | 113 | 132 |
| Trophozoites | 13 | 0 | 17 | 124 | 124 |
| Cysts | 73 | 97 | 87 | 64 | 123 |

**Table 2. Number of infections with trophozoites and cysts (identified or not) found in 500 stool specimens listed according to consistency of specimen**

| Type of stool | Number of specimens | Trophozoites only (a) | Cysts only (b) | Trophozoites with or without cysts (c) | Total infections (b plus c) |
|---|---|---|---|---|---|
| | | *Number* | *Number* | *Number* | *Number* |
| Formed | 350 | 36 | 56 | 78 | 134 |
| Soft | 150 | 36 | 18 | 48 | 66 |
| Total | 500 | 72 | 74 | 126 | [1] 200 |

[1] 7 of these were unidentified cysts or trophozoites of species that were considered to be identified on the basis of the combined findings of all techniques.

ing trophozoites would not in itself assure an increase in the number of infections detected unless trophozoites were present in the normally passed stool much more frequently than is generally believed to be so. In this study (see table 2), it was found that of 200 infections (identified or not) found by all 4 techniques, 126 (63 percent) contained trophozoites with or without cysts; the number of infections containing trophozoites only was 72 (36 percent). It is therefore apparent that any method that makes possible the detection of trophozoites will materially increase the number of positives which may be found.

It has been believed generally that amebic trophozoites are to be found primarily in soft stools, and infrequently in formed stools. (The term "soft" is used here to include all categories of stool which cannot be described as definitely formed.) If that were true, then the use of PVA-fixative could be restricted to soft specimens. The present observations do not appear to confirm this point of view. Of 134 infections found in formed stools, 78 (59 percent) showed trophozoites either alone or with cysts; and 36 (27 percent) showed trophozoites only (table 2). Thus, it would seem advisable to preserve even formed stools in PVA-fixative; otherwise, a sizable number of infections are likely to go undetected.

*Cysts.* The PVA-fixative method is relatively inefficient with respect to the identification of amebic cysts. Any one of the methods used on the unpreserved portions revealed a greater number of cysts than did the stained smears of the PVA-fixed portions (table 1). The question therefore arises as to whether the use of PVA-fixative would increase the number of positives above that which could be found by using all the three older techniques combined.

The hematoxylin-stained PVA film by itself revealed more infections than did all the techniques performed on the unpreserved portions put together (table 3). This was due primarily to the greater number of *Endolimax nana* infections which were detected in the PVA films. There was no significant increase in the number of *Endamoeba histolytica* infections, and there was a distinct decrease in the number of *Endamoeba coli* infections found.

*Combined Techniques.* Since no one method in this investigation was equally efficient for both trophozoites and cysts, it is obvious that the laboratory which is interested in recovering the greatest number of positives must plan to use at least 2 techniques to insure the finding of both stages.

Of the 4 techniques used here, the method of choice for trophozoites is, as has been shown, PVA-fixative. The number of infections obtained by combining the findings of the PVA-fixative method with those of each of the other methods used is shown in table 3. No combination of 2 techniques recovered as many positives as did all 4 techniques together. This reflects the experience of most diagnostic laboratories: The more a stool specimen is examined by various methods, the greater is the likelihood of finding the rare individual protozoan which may be present.

From a practical standpoint, however, the combination of the PVA-fixative and the zinc


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**Table 3. Number of identified infections found by various combinations of techniques**

| Combination of techniques | *Endamoeba histolytica* | | *Endamoeba coli* | | *Endolimax nana* | | All species | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Unpreserved portions (techniques 1, 2, and 3) | 27 | 71 | 32 | 82 | 44 | 62 | 117 | 66 |
| Hematoxylin-stained PVA film | 28 | 74 | 25 | 64 | 67 | 94 | 146 | 82 |
| PVA-fixative plus direct wet mount | 28 | 74 | 33 | 85 | 68 | 96 | 156 | 88 |
| PVA-fixative plus modified zinc sulfate concentration | 33 | 87 | 39 | 100 | 70 | 99 | 169 | 95 |
| PVA-fixative plus hematoxylin-stained direct smear | 33 | 87 | 29 | 74 | 70 | 99 | 160 | 90 |
| All 4 techniques | 38 | 100 | 39 | 100 | 71 | 100 | 178 | 100 |

sulfate methods would appear to be the most efficient combination of techniques. With these 2 methods it was possible to find 95 percent of the identified infections found by all 4 methods (169 of 178). The other 2 combinations—PVA-fixative plus hematoxylin-stained direct smears and PVA-fixative plus direct wet mounts—revealed 90 and 88 percent, respectively, of the total infections identified.

*Unidentified Organisms.* Of 16 cases where organisms were seen but were not specifically identified in the PVA-fixed portions (table 1), 12 (75 percent) were trophozoites. In most cases, these were *Endamoeba* organisms which could not be diagnosed definitely as either *histolytica* or *coli*. In our experience it has been impossible to identify specifically a proportion of *Endamoeba* trophozoites in stained preparations on the basis of the classic descriptions of the two intestinal species.

Since, in this study, the unpreserved specimens were several hours old when examined, the organisms not identified by the other techniques were mostly rare distorted cysts or degenerated trophozoites. When the resources of all 4 techniques were used, the number of organisms not identified was 15 compared to 178 identified, or 8 percent of all organisms seen.

## Summary

Five hundred normally passed stool specimens were divided into two portions immediately after passage. One portion was left unpreserved; the other was preserved in PVA-fixative. The unpreserved portions were examined by direct wet mounts, zinc sulfate concentrations, and hematoxylin-stained direct smears. The preserved portions were examined by hematoxylin stains of PVA films. All examinations were performed no sooner than 4 hours after the stool was passed.

The PVA-fixative portions revealed more infections with protozoans than did all 3 other techniques combined, mainly as a result of the preservation of trophozoites. Trophozoites were found in 63 percent of all infections detected and in 59 percent of the infections found in formed stools. This suggests that it is advisable to preserve both formed and soft stools in PVA-fixative. The combination of the PVA-fixative method (for trophozoites) and the zinc sulfate method (for cysts) demonstrated more infections than did any other combination of 2 techniques used in this study.

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# Technical Assistance for Public Health In the Republic of Indonesia

By E. ROSS JENNEY, M.D., M.P.H.

DESPITE the magnitude and complexity of public health problems in Indonesia, to conclude that the great need depicted there indicates, a priori, a corresponding scope for technical assistance would be a mistake. A sudden catastrophe in a highly organized society will utilize relief in direct proportion to need; but a socioeconomic dilemma developing over the centuries, like that which does exist in Indonesia, is probably of such a character as to limit sharply the fulfillment of its most desperate requirements.

The generalization may even be made that under these circumstances the capacity of an underdeveloped area to absorb technical assistance is inversely proportional to its need. Therefore, the corrective effort chosen should not precipitate a host of new problems by creating an unreasonable demand for housing, power, roads, transportation, interpreters, and the like. Regardless of the need and the amount of available aid, the vital measure of what can be done is the absorptive capacity of the area.

### Need for Foreign Assistance

An extraordinary number of surveys in the public health field have been made in Indonesia by a variety of agencies and individuals. Indonesian officials have reached the saturation point in the number of ideas which they can receive as to what should be done, and they are understandably skeptical about new proposals. Actually, the need for foreign assistance is fully recognized, and the Government is availing itself of aid proffered by the United Nations agencies, Technical Cooperation Administration, and other organizations.

Since foreign assistance and local capacity to absorb technical assistance are both perforce small in relation to the need in Indonesia, a big task falls on the shoulders of those who are guiding technical assistance and upon the Indonesian officials who are responsible for devising its efficient application. Measures of need in the form of surveys are necessary, as are estimates of indigenous resources, but the actual problem in Indonesia is to select a point of beginning, to choose an open avenue of approach which will not prove to be an ultimate dead end.

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*Introductory to understanding the health problems of Indonesia and the difficulties of administering technical aid in Southeast Asia is Dr. Jenney's background report on "Public Health in Indonesia" in the April 1953 issue of Public Health Reports (p. 409).*

*A commissioned officer in the Public Health Service, Dr. Jenney was assigned for 2½ years to the Technical Cooperation Administration (TCA) Mission to Indonesia as chief of the public health division. Dr. Jenney's current assignment has taken him to Santiago, Chile, as chief of the health and sanitation field party of the Institute of Inter-American Affairs.*

*Another aspect of technical assistance in Indonesia—in this instance the special problems encountered in two rural polyclinics in Middle Java—is described by Warren A. Ketterer on p. 558 of the June issue.*

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The need for technical assistance in Indonesia in the public health field does not differ basically from the need for more outright economic aid. During the 3½ years of Japanese occupation in World War II and during the subsequent struggle for independence, public health facilities on the group of islands deteriorated. Technical health personnel were lost to the islands because of the exodus of many of the Dutch. The same is true of agriculture, engineering, and mining: everywhere there is a shortage of tools and of those who know how to use them. A rapidly increasing population progressively accentuates these deficiencies, and a preoccupation with the complexities of new sovereignty and its political implications of hope and of disappointment compromises the effectiveness of remedial measures.

This preoccupation is exasperating to all those whose technical talents and professional thinking were developed in an environment of economic, social, and political stability. But the preoccupation is real, and it is not to be overridden by any plan of proffered assistance which does not recognize and sympathize with the fact that Indonesian Government officials are all filling dual and triple positions, each position enmeshed with a complexity of political and administrative issues. Eager to utilize either the short-range impact value or the long-range economic value of any project, the Indonesian Government is examining every opportunity to lessen the disappointment of the country in discovering the initial problems of independence.

The reaction which a given community may develop as a consequence of receiving a service previously unknown is somewhat irrelevant to the actual situation confronting the Indonesian Ministry of Health. Indonesian officials are naturally impatient with schemes which introduce a new service in a limited sphere while the major issue of rehabilitating former services remains unaffected. This attitude does not mean a condemnation of a scheme per se but simply an impatience with its irrelevancy at this time. When the load is heavy, foreign assistance should add another horse rather than another cart.

The large rural population of Indonesia is relatively stable, and its stability is based on the subsistence-level individual farmer. The people are illiterate, patient, intelligent, and receptive, but not reactive. They harbor guerrillas, but they do not mobilize armies; they absorb ideology, but they resist the call-to-arms phase of propaganda. The rural population has a keen desire to participte in new developments which may improve its economy, regardless of the source, but it likes to feel the impact of such developments through its own Government. However, many areas seem to have a natural taste for local autonomy.

The indications are that the rural recipient of technical assistance is being and will be reached by assistance which is channeled through the Ministry of Health. Reaction which redounds through official health channels is far more effective in the long run than reaction which develops from assistance dropped, as from a parachute, to an isolated rural community.

### Choice of Approach

The task of national planning in a situation such as prevails in Indonesia is new. Only recently has public health advancement in a large underprivileged population been considered as the full responsibility of an indigenous government. The task requires a different orientation from that evolved by colonial governments, missionary organizations, and the like. The task of national planning comes at a time when new insecticides and new drugs have changed the mechanism of disease control projects and at a time when global air transport facilitates rapid interchange of technical personnel. Most important, it follows at the heels of the "awakening of Asia."

The situation in Indonesia has certain distinct features which accentuate or modify the health picture, making it somewhat unique. Geographically, the Republic of Indonesia is the most complex nation on earth, and this complexity accentuates the logistics of transportation and communication. Its health services, although qualitatively good, are quantitatively perhaps the most deficient of any nation. Indonesia also faces a rather formidable language problem, since its secondary language—Dutch—is of limited use in general interna-

tional contacts. This forces the Indonesians to make special effort to speak English and creates a demand in many Government departments for English-speaking officials, many of whom are leading physicians and surgeons withdrawn from their medical activities by the Government.

With trained personnel and funds so scarce in relation to the need, the choice of the most expedient approach to meeting the need cannot be influenced by prejudices previously formed in an atmosphere of affluence. Those who have faced decisions in similar situations will agree that it is not an easy concept to keep constantly in mind. The age-old puzzle presents itself: which dollar is the most expedient in a given situation—one, the dollar spent in economic improvement with its consequent effect on health and education; two, the dollar spent on education with its effect on health and economics; or three, the dollar spent on health to provide manpower for economic development and sound minds for education?

### *Question of Emphasis*

This choice of accent assails the planner at every step whether he is thinking in terms of the entire nation or of a single village. It will be a long time before there will be the human and financial resources in Asia to allow a simultaneous approach to all three avenues on an adequate scale. Occasionally, the choice is easy, but centuries of failures throughout world history give evidence that the weak spot in the eternal cycle of ignorance, poverty, and disease has been recognized by hindsight more readily than by foresight.

There are areas in Indonesia which have been drained of their best intellects because education provided opportunity for better reward elsewhere. One of the most poverty-stricken areas, with an infant mortality of 53 percent, is paradoxically one of the most literate areas. The failure here was perhaps because education was at an academic level, neglecting the more basic local needs at the trade school or agricultural school level.

Again, obvious failures can be seen in the transmigration areas of Sumatra and Celebes to which Javanese farmers were transplanted. Some of these transmigrations resulted in tragic debacles because of malaria, which should have been the first consideration. Consequently, the elaborate economic preparations—and even educational and clinical facilities—proved to be expensive and futile plans, defeated by the overlooked mosquito. The abandoned paddies remain as monuments to the oversight.

### Trend of Foreign Assistance

All issues which have given rise to a need for technical assistance in Indonesia are influenced by either one of two factors. One of these is the underdevelopment of resources. Another very different factor is the deterioration of what has already been developed. The former is too extensive to measure—the need can only be identified; it is immeasurable in relation to present capacities to meet it. The latter—deterioration of what has been developed—is measurable and therefore is useful in planning; it can be weighed against existing capacities to correct it with available assistance. The rehabilitation of a worthwhile but deteriorating health facility is a tangible and sound objective. In Indonesia, there is ample opportunity in this field because of the framework of public health facilities instituted under the Dutch but severely depleted during World War II and because of the subsequent period of protracted military action.

This deterioration, which leads to a disappointment to Indonesia as it first experiences freedom, is only part of a general progressive decline in many fields other than public health. The restitution of public health services has an advantage in that it is not fraught with the quandaries encountered in the economic field, such as the feasibility of rebuilding a sugar mill in the face of doubtful markets.

In the health field in Indonesia, technical assistance, supplies, and equipment from outside agencies are being devoted to (*a*) major disease control projects which introduce effective methods and which are administratively feasible under the present circumstances, particularly in yaws and malaria; (*b*) educational projects in professional and subprofessional medical fields and in popular health educa-

tion; (*c*) the support of certain indigenous preventive programs selected partly because they are in a position to utilize assistance to full advantage and to continue in the future; and (*d*) emergency items to replenish depleted medical services.

### Psychological Aspects

Many devices have been used to illustrate the conflict arising when a conventional Eastern mind meets a conventional Western mind. In this day of airborne technicians and consultants, the conflict has a new meaning in terms of its potentiality for wrecking plans. A necessary part of planning, therefore, is the consideration of the tendencies of the East to misinterpret Western methods and of the West to overestimate the applicability of these methods. In the past it has been possible for the various agencies on encountering this conflict to allow time for adjustment and to select men of experience who were prepared to dedicate a substantial portion of their lives to reach an understanding with the Eastern mind. During the last few years, however, countless Western technicians have been sent to the East and have been given perhaps no more than a few days to establish a liaison which history has proved to be difficult to obtain in years. To these men it is a matter of desperate necessity constantly to check their own prejudices, of which they may have been unaware, and the prejudices of the East, which Eastern officials by virtue of courtesy and restraint do not reveal at once.

The newly arrived Western technical expert will be disappointed if he places too much confidence in community reaction. Eastern communities are cohesive units in certain aspects pertaining to well-established cultural mores, but they are not apt to produce a joint-action response to an innovation. They do not "write to their congressmen" to demand action for their community.

#### *Achieving Cooperation*

Because of a deep cultural stability, which cannot be moved with bulldozer and steam shovel techniques, Eastern communities are resilient in absorbing external shock. A sense of courtesy prevents an Eastern official from explaining in advance that a particular project is in opposition to the established cultural pattern. The Western technician must anticipate what opposition to expect if he is to see his project not defeated, but he rarely will be warned. New methods are not resented—quite the contrary—but their adoption depends on the method of introduction. There is always a right way and a wrong way to introduce them depending on the cultural climate of the area concerned.

In the East, every situation must be explored completely; if not, an elaborate program may collapse because no one had discovered that the ferry boat—"it was shown on the map"—no longer exists. Printing facilities, communications, transportation, housing, electricity, and interpreters and stenographers are all on an "if available" basis. The East receives its supplies from many sources; so, the ribbon may not fit the typewriter, nor the electric bulb the socket, nor the needle the syringe. These irritations may be minor or they may be of sufficient magnitude to compromise an entire project.

In a nation the size of Indonesia, one must beware of being too well satisfied with progress in any single instance, particularly if it represents an insignificant fraction of the whole. The philosophy of "any good is good however small" is all very well, but the quart of water should be used to prime the pump rather than given to the passer-by. Technical assistance meant to have catalytic effect should reach the people through agencies which can be expected to continue the work permanently. The development of a single isolated project is useful in the national sense only when it is designed to serve as a demonstration center for teaching purposes. The demonstration center development in Indonesia has been a happy compromise between the danger of losing effect by dissipation of effort on the one hand or losing effect by single-area concentration on the other, but here again the demonstration center had to be associated with a permanent and dependable agency.

The Eastern official participating in cooperative development programs tends to assume that he can bridge the gap between Eastern and Western technology by acquiring the latest, the

largest, and the most complicated apparatus without thought for its maintenance, operation, or utility. This is a well-known tendency and certainly is not exclusively Eastern. It is exemplified by expensive X-ray units combined with inadequate darkroom procedures, or by huge tractors for small fields. Avoiding such errors as these is often the first, and sometimes the most important, element in a technical assistant's contribution.

### *Difference in Attitudes*

An eagerness to institute research may present a formidable problem. The Eastern mind is particularly adapted to investigation, and its achievements are too well known to need comment. However, because of the progress of research in the West during the war years, a grant in the East today may lead to unnecessary duplication or to the exploration of remote aspects of the problem before the application of basic knowledge. Research must not be discouraged, yet the assisting agency must assure itself that established principles are followed in the programs for which it is responsible. The severing of scientific liaison between the East and the West during the war has produced a confusion which will require many years of positive action to correct before research in the two areas will complement rather than overlap.

The Eastern physician tends to focus his efforts on therapeutic medicine rather than on preventive medicine because of the much greater personal reward in the former branch of medicine. This is true the world over, but the contrast in the East is greater, where the choice may be between wealth and fame and poverty and anonymity. The Western technician can assist in correcting this discrepancy; indeed, it is one of his basic objectives. The task, however, is profoundly difficult until community responsibility for the preservation of health has been acknowledged. Until that comes about, the demand will be for therapy, and the response will be in accordance with the demand. The most constructive step to take in the meantime is for organized teams to demonstrate the value of preventive medicine to the community.

The Eastern mind is not as conscious of the importance of problem-solving as is the Western mind. In the East, to acknowledge the existence of a problem is often considered adequate. There, if a community is told that something "will be done as soon as possible," the "when?" will not be asked. This Eastern reaction, of course, stems from a long experience with deprivation, but it is also a reflection of the difference between East and West in concept of time. This attitude is not a matter of indifference nor of procrastination: it is something quite apart and is difficult for the foreign mind to comprehend. Six months hence and twelve months hence represent not different times, but simply—"the future." This attitude toward time produces an exasperating conflict with Western scheduled methods, but there is a certain realistic wisdom in it which gradually induces the Westerner, perhaps not to adopt the same attitude but to recognize it as locally meaningful, at least until the "something must be done about it" philosophy is accepted in the East.

Finally, either Westerner or Easterner may assume that all difficulties in an ex-colonial nation stem from mismanagement by the former colonial power. This may well be true in specific instances but to adopt any broad generalization is a dangerous obstacle to clear thinking. One must first look critically at the status of those nations or areas of nations which have never experienced colonialism. The adoption of the scapegoat philosophy to explain shortcomings is certainly no help as a basis for discussion and will soon develop a false sense of optimism as to the likelihood of success. The common phrase "nothing has been done for these people" is easy to repeat off-hand, but it is not always supported by a study of the facts. A careful investigation of facts will often show a long history of desperately frustrated effort on the part of the local people against insurmountable odds or against factors which, it must be remembered, were insurmountable until the advent of such effective agents as DDT and the antibiotics.

## Java and Demography

The foregoing has depicted certain problems which challenge the planning capabilities of public health authorities in Indonesia. It must be acknowledged that these problems are com-

plicated by certain logistic factors of a magnitude rarely encountered. In some respects they are specifically Indonesian problems because of the extraordinary geography of this nation of islands. The public health planner, however, when considering such obstacles, is confronted by an ominous population situation which overwhelms all other aspects. As a demographic dilemma, the Island of Java is one of the world's most crucial spots. To appreciate this, an academic background is unnecessary: living in Java is enough to instill a sense of dangerous human saturation.

Estimated at 10 million a hundred years ago, the population of Java and nearby Madura is now 52 million and is now increasing by more than 5 million persons a decade. Although the gravity of the situation had been long recognized by the Dutch, the 1930 census figures of 41 million, the population of France at that time, first focused world attention on Java as an island of incredible population density. In 1930, the birth rate of Java and Madura was reported as 27.9 per 1,000 people and the death rate as 19.9. The present rate of increase is thought to be at least 1.5 percent a year, which, unless there are intervening deterrents, would bring the population of Java and Madura to over 100 million before the end of the century. Whether the less severe population deterrents observed in similar situations will obtain in Java, or whether the most paradoxical famine the world has yet experienced will develop in this garden island remains to be seen.

### *Supply of Rice*

Population increase has more than kept pace with increased productivity of rice by irrigation, fertilization, and improved seed, but in Java a finite remedial limit to this productivity is not far away. The per capita daily cost of rice—rice is the hinge of Java's economy—has risen to a figure which is approaching the basic daily wage while rice imports are exceeding a half million metric tons a year.

Some relief may be afforded by a change in food habits, but perhaps the most hopeful project, or at least one that may postpone the crisis longer than any other, is mechanized rice production. This project proposes the development in Borneo, in Sumatra, and in Celebes of mechanized production areas, operated largely to supply rice to Java's millions.

The story of two disasters reveals the precarious position of the Javanese economy more dramatically than economic theories. The first disaster was the depression of 1929, which struck a sudden and fearful blow at the economy of Java. The second was the Japanese occupation of the island, which brought to light the dangerous imbalance between rice and population. World War II cut off vital imports at the same time that the Japanese army was withdrawing rice from Java to feed its troops in New Guinea. The result was widespread starvation in Java and an estimated 2 million deaths.

### *No Ready Solution*

Reduction of population growth by control measures would require a mutation in cultural mores over a period of time too long to solve the problem of imbalance. Permissible polygamy, the prestige value of early marriage and large families, and the status of women in general are all contributing cultural factors. In the absence of any other form of insurance, the value of many children and grandchildren in an agricultural family is an age-old incentive for uncontrolled reproduction.

Since all Indonesia except Java and Madura is relatively sparsely settled, the concept of transmigration is appealing. Transmigration was begun many years ago by the Dutch. Because it is a sound project for economic development, it will probably continue, but it can have little effect on the population of an island that is increasing by more than a half million persons a year.

While we are promulgating public health programs in the presence of such a formidable dilemma, we hear protest against measures which will decrease infant mortality and only add to the magnitude of the impending disaster. There always has been headshaking over the wisdom of saving lives in famine areas, but in recent years the headshaking has given way to concise and sometimes cynical expressions of disapproval. Public health measures are attacked for doing no more than preserving lives for ultimate starvation. Since we face the choice between disease and famine, so the critics

say, let us preserve disease to eliminate a fraction of the population so that we can avoid famine for the whole. This is indeed a strange bedfellow to be espoused in the cause of human welfare.

To preserve disease is to allow unnecessary death and incapacity for work. How much of a gap is there between allowing death and arranging it? The proposal is dangerously close to genocide and is unacceptable even if it were not known that birth rates rise with disease, ignorance, and poverty and eventually decline with better health, education, and economic status. The fact that the reaction is eventual, and not immediate, can have no bearing on the wisdom of the objective selected, for no solution is immediate.

No program devoted to human welfare can afford to treat disease, poverty, and ignorance as if they were separate entities striking a community merely by coincidence. We know too well that they are part of one another, inseparable in both cause and solution. One can scarcely imagine a malaria-stricken farming population staggering off to increase the rice yield, of yaws-infected school children winning their way to better things, all patiently anticipating the day when someone decides that it is safe to institute disease control. The illiterate villagers are apt to know, by virtue of having lived with their problem since time began, that they cannot meet the demands of education and improved economy without the hope of being healthy.

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**PHS films**

## Epizootiology of Anthrax

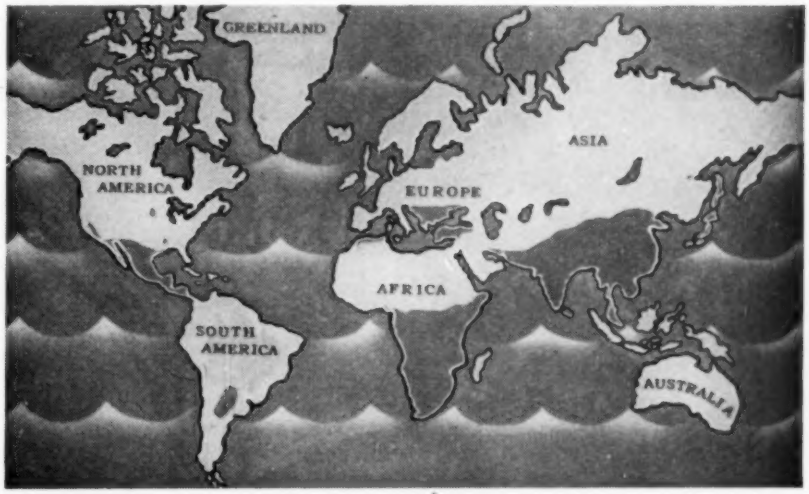
**35 mm., sound, color, 9 minutes, 1952.**

**Audience: Veterinarians, practicing physicians, instructors and students in veterinary and medical schools, and public health personnel interested in anthrax.**

**Available: Loan—Communicable Disease Center, 50 Seventh Street, N. E., Atlanta, Ga. Purchase—United World Films, Inc., 1445 Park Avenue, New York 29, N. Y.**

This film is designed as an aid in diagnosing and controlling anthrax, for centuries a killer of man and his domestic animals. Although modern antibiotics have contributed toward its control, it is still a serious problem to stockmen, veterinarians, and public health workers.

In depicting the epizootiology of anthrax, the film shows the cycle of infection and appearance of the spores of the etiological agent, *Bacillus anthracis*. The case history of the spread, diagnosis, and final control of an epizootic of anthrax arising from an imported shipment of bonemeal which was contaminated with the spores of *B. anthracis* is included. Attention is called to the worldwide distribution of anthrax endemic areas, the susceptibility of animals to the disease, the usual modes of infection, and the application of control measures.




**Anthrax occurs throughout the world. (Endemic areas indicated by shaded areas.)**

The control of anthrax, the film points out, depends on early diagnosis followed by thorough sanitary measures and the constant vigilance and cooperation of stockmen, veterinarians, and public health officials.

# Histoplasmin Sensitivity In Mississippi— A New Boundary

By Robert M. O'Neal, M.D.

In northern Mississippi, infection with histoplasmosis is about three times as common as in the southern half of the State. This is especially true of the delta section in the northwest.

Results of a study to evaluate the significance of skin tests for systemic mycoses suggest that the northern part of Mississippi lies within the area of endemic histoplasmosis in the United States. The study more clearly defines the southern border of this area, which is usually described as the middle west or the Mississippi River Basin and as extending south through Tennessee. Mississippi to the south thus compares as a border State with Kansas to the west of the area of high prevalence, although the demarcation is more definite in Kansas. Christie (*1*) considered Mississippi a part of the endemic area when he reported high infection rates of over 55 percent whereas Palmer (*2*) considered the State to be south of the area of high prevalance.

### Skin Test Reactions

In the present study, skin tests with histoplasmin, blastomycin, and coccidioidin were performed on 295 patients of the Mississippi State Sanatorium, the only tuberculosis sanatorium in Mississippi, during the period March 1951 to March 1952. Sixty-five of the group (22 percent) reacted positively to histoplasmin (see table).

In northern Mississippi, 31.5 percent of the patients tested were positive reactors to histoplasmin. In southern Mississippi, 12.8 percent were positive. Only 0.7 percent (2 patients) reacted positively to blastomycin, and 0.7 percent reacted positively to coccidioidin.

Neither of the two positive reactors to blastomycin reacted to histoplasmin, but both reactors to coccidioidin had positive reactions to histoplasmin identical in size to the coccidioidin reactions. Both also gave a definite history of infection typical of coccidioidomycosis during residence in the San Joaquin Valley in California. The following statistical data, therefore, refer only to the histoplasmin test.

### Geographic Variation

When all tests were plotted as to county of residence (see map), it was apparent that there was a significant geographic variation. County of residence was considered the one where patients had lived for 1 year prior to admission to the sanatorium.

For the purposes of the study, the State was divided into northern and southern Mississippi along an imaginary line at the Big Black River which flows east-west centrally into the Mississippi River. Below the Big Black River are the coastal plains. Above the river are the delta section of the northwest and the hills of northeastern Mississippi.

Of the 149 patients residing below the dividing line of the river, 19 (12.8 percent) were positive to histoplasmin. Above the river, 46 (31.5 percent) of the 146 persons tested were positive. This difference is statistically significant.

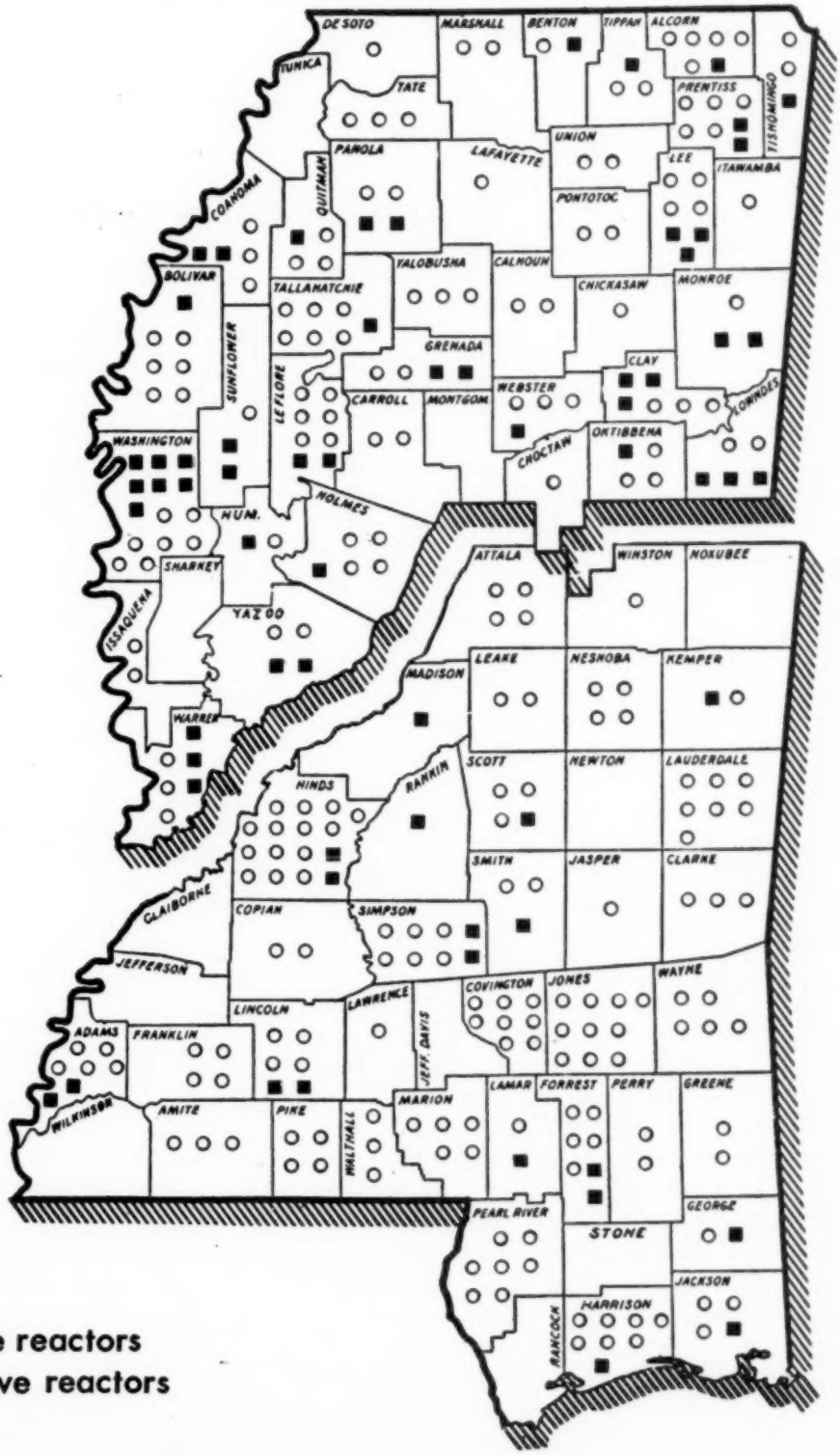
When the 13 counties in the delta section of northwestern Mississippi, the area of greatest prevalence, were considered apart from northern Mississippi, 61 tests were plotted for the area. Twenty-two (36.0 percent) were positive to histoplasmin. Our proven case of histoplasmosis (unreported) was from Bolivar County in the delta. It was not included in the skin tests because it was a diagnostic problem.

### Materials and Methods

Blastomycin, coccidioidin, and histoplasmin concentrates were prepared each month in a sterile dilution of 1:1000 which was kept under refrigeration. New syringes were used and labeled for the respective antigens. One-tenth

*Dr. O'Neal, now an American Cancer Society clinical fellow in pathology at the Massachusetts General Hospital, Boston, was with the medical service of the Mississippi State Sanatorium, Sanatorium, Miss., in 1949–52.*

# Geographic distribution of histoplasmin skin tests in northern and southern Mississippi



**Results of histoplasmin skin tests in Mississippi**

| Item | Total | Sex | | Race | | Geographic division | |
|---|---|---|---|---|---|---|---|
| | | Male | Female | White | Negro | Northern Mississippi | Southern Mississippi |
| Number of tests | 295. 0 | 127. 0 | 168. 0 | 207. 0 | 88. 0 | 146. 0 | 149. 0 |
| Percentage of reactors | 22. 0 | 28. 3 | 17. 3 | 19. 8 | 25. 0 | 31. 5 | 12. 8 |
| Standard deviation | 2. 41 | 4. 00 | 2. 92 | 2. 77 | 4. 62 | 3. 84 | 2. 74 |
| Difference | ---------- | 11. 0 | ---------- | 5. 2 | ---------- | 18. 7 | ---------- |

cubic centimeter of antigen was injected intradermally into the skin of the left forearm (histoplasmin), right forearm (blastomycin), and right upper arm (coccidioidin) simultaneously as suggested by Smith (*3*). Tests were read at 48 hours, and induration of 5 mm. or more was considered positive. Doubtful tests—there were only two—were considered negative.

The subjects were routine sanatorium admissions between 12 and 63 years, with an average age of 35.1 years. The age distribution in the northern and southern sections was not determined, and it is believed there could be little variance between the two samples. Age, however, was not considered in evaluating results because the percentage of histoplasmin sensitivity is highest in the young adult and middle age groups composing most sanatorium admissions (*4*, *5*).

Critically ill patients were avoided because "critical illness exerts a depressing effect on skin sensitivity to tuberculin and histoplasmin" (*6*). Tests performed as diagnostic studies were excluded in an attempt to avoid sampling error.

## Other Findings

*Sex.* Of the 127 men tested, 36 (28.3 percent) were positive to histoplasmin (see table). Of the 168 women, 29 (17.3 percent) were positive. This agrees with other studies which have determined that the rate of infection is slightly lower in women (*5*). The differences in this study are not statistically significant.

*Race.* Of the 207 white patients, 43 (19.8 percent) were positive. Of 88 Negro patients, 22 (25 percent) were positive. This differs from other studies in which the whites seemed to be more sensitive than the Negroes (*5*, *7*), but the difference in rates is not statistically significant.

## Statistical Significance

On the basis of the histoplasmin tests, the difference between the prevalence of reactors in northern Mississippi and those in the southern area is more than 2.5 times the standard deviation of the difference. Using this same level of significance, no significant difference between the Negro and white patients was demonstrated, and the difference between the sexes was of questionable significance.

NOTE: Blastomycin concentrate (B–8564) and histoplasmin concentrate (CT–189) were furnished by Eli Lilly & Co., Indianapolis. The coccidioidin (special dilution 1:10, lot 49028) was obtained from Cutter Laboratories, Berkeley, Calif.


### ACKNOWLEDGMENT

Miss Margaret E. Rice, supervisor of public health statistics, Mississippi State Board of Health, assisted in analyzing the findings.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*A Quantitative Study*

# Recipients of the Master's Degree In Sanitary Engineering

By WALTER A. LYON, M.S.S.E., and ARTHUR P. MILLER, C.E.

TO PERMIT a quantitative assessment of the present and future supply of trained sanitary engineers, it is necessary to determine the number of graduates who follow the profession. In an earlier report (*1*), such data were provided concerning graduates from undergraduate curricula and options in sanitary engineering. The present study is designed to provide similar information about those who have completed graduate work in sanitary engineering at the master's level.

In order to throw additional light on the place of graduate work in sanitary engineering education, certain other statistical data are also discussed. These relate to the undergraduate background, the amount of experience prior to entering graduate school, and the employment distribution of the graduates. Particular attention is given to characteristics that the graduates from individual schools have in common with respect to prior experience and choice of employment.

## Method and Data Used

Miller (*2*) showed that 44 universities and colleges in the United States at some time during the period 1899–1951 granted the master's degree to individuals majoring in sanitary engineering. From these, a group of 28 institutions was drawn. These schools granted the master's degree in sanitary engineering to 1,023 nationals of the United States during the period 1900–1951. This number of graduates, constituting 86 percent of all United States nationals receiving a master's degree in sanitary engineering during those 52 years (1900–1951), was used as the basic material for this study.

The universities and colleges in the group were divided into two subgroups: one consisting of those schools which, in our study, were represented by 30 or more respondents who were United States nationals and the other by those which had fewer than 30. In this way, 7 "heavy producers" (Harvard University, Johns Hopkins University, Massachusetts Institute of Technology, University of Michigan, New York University, University of North Carolina, and University of Wisconsin) and 21 "light producers" were selected in order that data might be provided for both classes of institutions. Although the number of heavy producers was somewhat disproportionate, the number of light producers which are included assures their representation. Wherever there were statistically significant differences between the characteristics of schools or between "heavy and light producers," these will be indicated as significant.

In the analysis of the data, tests for significance were used where the need for such a test arose. Wherever, in this report, a difference is indicated as being "significant," this means that the difference was significant at a level of P=.05. The test employed was that described by Zubin (*4*) which by the use of nomographs determines the significance of the differences between

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the relative frequencies of events in two contrasted series or groups.

The colleges and universities included in the study provided lists of their graduates and the best available mailing address for each one. An explanatory letter with a reply post card was sent to each person and followup action was taken as long as it appeared to be productive of results. The information given by each respondent was edited, coded, and entered on punch cards for mechanical tabulation. Usable data were obtained from 874 individuals or 85.4 percent of the group (1,023) to whom cards were mailed. Those who had also earned doctorate degrees in sanitary engineering were excluded.

Table 1 shows a summary of the total number of master's degrees in sanitary engineering granted by the 28 schools in the sample, the number of respondents from each institution, and other information concerning the composition of the sample.

**Table 1. Summary, as of 1951, of information on recipients of the master's degree in sanitary engineering from 28 colleges and universities, 1900–1951**

| Institution | Total [1] | Recipients of the master's degree | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Nationals of other countries | Nationals of the United States | | | | | |
| | | | Total | Dead | Excluded [2] | Respondents | | |
| | | | | | | Total | In profession | Out of profession |
| Total | 1,293 | 270 | 1,023 | 21 | 128 | 874 | 763 | 111 |
| Alabama Poly. Inst | 3 | 0 | 3 | 0 | 1 | 2 | 1 | 1 |
| California, Univ. of | 31 | 1 | 30 | 0 | 8 | 22 | 18 | 4 |
| Case Inst. of Tech | 16 | 1 | 15 | 0 | 2 | 13 | 5 | 8 |
| Cornell Univ | 31 | 10 | 21 | 1 | 3 | 17 | 13 | 4 |
| Florida, Univ. of | 17 | 5 | 12 | 0 | 1 | 11 | 11 | 0 |
| Harvard Univ | 478 | 98 | 380 | 9 | 50 | 321 | 297 | 24 |
| Illinois, Univ. of | 13 | 2 | 11 | 0 | 1 | 10 | 10 | 0 |
| Iowa State Col | 11 | 1 | 10 | 0 | 2 | 8 | 5 | 3 |
| Iowa, State Univ. of | 18 | 6 | 12 | 0 | 0 | 12 | 10 | 2 |
| Johns Hopkins Univ | 48 | 8 | 40 | 0 | 3 | 37 | 36 | 1 |
| Kentucky, Univ. of | 3 | 0 | 3 | 0 | 0 | 3 | 3 | 0 |
| Massachusetts Inst. of Tech | 93 | 18 | 75 | 0 | 11 | 64 | 55 | 9 |
| Michigan State Col | 5 | 0 | 5 | 0 | 0 | 5 | 5 | 0 |
| Michigan, Univ. of | 200 | 67 | 133 | 6 | 11 | 116 | 99 | 17 |
| New York Univ | 102 | 1 | 101 | 1 | 13 | 87 | 75 | 12 |
| North Carolina State Col | 9 | 2 | 7 | 0 | 0 | 7 | 3 | 4 |
| North Carolina, Univ. of | 98 | 46 | 52 | 2 | 6 | 44 | 40 | 4 |
| Northwestern Tech. Inst | 3 | 0 | 3 | 0 | 1 | 2 | 1 | 1 |
| Oklahoma Agri. and Mech. Col | 3 | 0 | 3 | 0 | 0 | 3 | 3 | 0 |
| Oregon State Col | 5 | 0 | 5 | 0 | 1 | 4 | 3 | 1 |
| Purdue Univ | 16 | 1 | 15 | 0 | 3 | 12 | 11 | 1 |
| Rensselaer Poly. Inst | 3 | 0 | 3 | 0 | 1 | 2 | 2 | 0 |
| Rutgers Univ | 2 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| Tennessee, Univ. of | 3 | 1 | 2 | 0 | 1 | 1 | 1 | 0 |
| Texas, Univ. of | 10 | 0 | 10 | 0 | 3 | 7 | 7 | 0 |
| Virginia Poly. Inst | 20 | 0 | 20 | 0 | 0 | 20 | 16 | 4 |
| West Virginia Univ | 3 | 0 | 3 | 0 | 0 | 3 | 3 | 0 |
| Wisconsin, Univ. of | 49 | 1 | 48 | 2 | 6 | 40 | 29 | 11 |

[1] See reference 2.

[2] Excluded because of no or insufficient information. In this group, there are 30 who also obtained a doctorate degree.

### Schools and Their Graduates

The number of schools granting the master's degree in sanitary engineering has kept pace with the rapid increase in the number of such degrees awarded. Ten colleges were awarding the master's degree to individuals majoring in sanitary engineering by 1925; by 1935 the number had risen to 22, by 1945 to 32, and by 1951 to 44 with an additional 13 schools prepared to do so if candidates presented themselves.

The student load carried by the schools is not equally distributed. For example, of all the degrees granted during the last decade (1942–51), almost two-thirds were awarded by one-eighth of the schools active during that period.

### Loss From the Profession

For the purpose of this study, a graduate was considered to have remained in the profession if, during the year 1951, he was in an occupation in which he devoted all or part of his time to the application of engineering knowledge in the control of the environment in order to promote and protect the public health in administrative, promotional, operational, teaching, testing, design, or research activities.

In the bachelor's level study (*1*), all those who spent 50 percent or more of their time in sanitary engineering work were classified as being in the profession. In this study, all those who were practicing sanitary engineering any portion of their time were so classified. This change in definition accounts for 8 of the 35.8 percent difference between the "percents remaining in the profession" when the bachelor's and the master's groups are compared.

As stated before, the total number of students from the schools in the sample from whom usable information was received was 874; of these, 763 or 87.3 percent remained in the profession in 1951.

If we compare the percents remaining in the three educational levels, we find the following distribution:

| *Degree level of graduates* | *Percent of graduates remaining in the profession* |
|---|---|
| Bachelor's | 51.5 |
| Master's | 87.3 |
| Doctorate | 97.3 |

The figures above are based on degrees granted rather than on individuals. The same person may have been included twice or even three times. (The number of doctorate degrees earned in sanitary engineering to date is relatively small; therefore, data on them are used in this study only in this one comparison.) Most of those who received doctorates had also received the master's degree in sanitary engineering. This is not true, however, for those who earned degrees only to the master's level. Only about one-third of these had studied sanitary engineering at the undergraduate level.

The difference in percents remaining between the bachelor's and the master's degree levels even after taking into consideration the 8 percent accounted for through change in definition previously mentioned is about three times as great as the difference between the master's and the doctorate levels. The difference in percents remaining between the bachelor's and the master's levels is probably due in part to the fact that most of the master's degrees were granted more recently than most of the bachelor's degrees. The median master's degree in the sample used in this study (1900–1951) was granted in 1947. The median bachelor's degree in the undergraduate study (*1*) (1910–49) was granted in 1937. This means that the median bachelor's level graduate has had more time (that is, more of a chance) to leave the profession than has the median master's degree recipient.

In comparing the percents of graduates from each school who have remained in the profession, only the graduates during the 1942–51 period were considered, because a number of the schools in the study did not begin to grant the master's degree in sanitary engineering until some time during that period.

As shown in table 6, there were relatively small differences in the percents remaining among those from each school. In some cases, the number of graduates involved was too small to permit drawing significant conclusions.

When the heavy producers during the 1942–51 period were compared with the light producers, a significant difference in the percents remaining was found. (Since, for the 1942–51 period, the line of division between heavy and light producers was drawn at 15 respond-

ents, the University of California is included for this period only among the heavy producers.) For the heavy producers, the percent remaining was 93.5, whereas for the light producers it was 84.7. The reasons for this difference will become more obvious in the discussions of pregraduate-school experience and type of employment which follow.

### Undergraduate Background

The undergraduate background of about half of the master's degree recipients in sanitary engineering was the civil engineering curriculum; somewhat more than a third completed the sanitary engineering option of civil engineering or the sanitary engineering curriculum; and about one-sixth completed some other type of engineering curriculum. Table 2 shows this, the percents remaining, and the percents which had pregraduate-school experience for each type of undergraduate work.

Table 2 also shows that increasing percents of the master's degree recipients who had undergraduate work in civil engineering, the sanitary engineering option of civil engineering, sanitary or public health engineering, and other types of engineering curricula, remained in the profession. The percents who have had 1 year or more of pregraduate-school experience vary in the same order. The differences in these percents are small, but they follow a pattern which suggests the general rule that the more a man is exposed to sanitary engineering either via experience or education, the more likely he is to remain in the profession.

**Table 2. Distribution of type of undergraduate curriculum completed by percent remaining in the profession in 1951 and pregraduate-school experience in sanitary engineering**

| Undergraduate curriculum completed | Recipients of the master's degree | | | |
|---|---|---|---|---|
| | Total | | Percent remaining in the profession in 1951 | Percent with 1 year or more of pregraduate-school experience |
| | Number | Percent | | |
| Total | 874 | 100.0 | 87.3 | 52.5 |
| Civil engineering | 421 | 48.2 | 86.2 | 46.3 |
| Civil engineering-sanitary engineering option | 266 | 30.4 | 86.8 | 53.8 |
| Sanitary or public health engineering | 38 | 4.3 | 89.5 | 60.5 |
| Other engineering | 149 | 17.1 | 90.6 | 65.8 |

### Experience Prior to Graduate Work

Many of those who earned the master's degree in sanitary engineering had gained some experience in the field before beginning graduate work. In this study, we have assumed that only those who have had 1 year or more of such pregraduate-school sanitary engineering experience have had a significant amount of such experience. Table 3 indicates that more than half of the master's degree recipients fall into that category.

About 57 percent of those who remained in the profession after having completed graduate school work, had a year or more of pregraduate-school experience whereas only 24 percent of those who left the field had such experience. This is, of course, to be expected since an engineer who had some pregraduate-school experience has had more chance to decide whether or not he likes sanitary engineering than one who has not. Actually, of the 874 graduates in the sample, only 27 or 3 percent who had had pregraduate-school experience, left the profession at some time subsequent to the completion of graduate work.

When the graduates are grouped by the type of their 1951 employment, there are considerable differences in the proportions who had pregraduate-school experience. Table 4 demonstrates this.

The second column of this table shows the percents of all sanitary engineers in each type of employment who have reached the master's level of education. This could be considered as an indication of the extent of utilization of master's level men in each employment category. The fourth column shows the percents of graduates in each employment category who have had a year or more of pregraduate-school experience. This may be considered an index of the opportunity given by the employer, or taken by the student, to return to school for graduate work.

**Table 3. Distribution of years of sanitary engineering experience gained prior to entering graduate school and percent remaining in the profession in 1951**

| Years of pregraduate-school experience in sanitary engineering | Status of recipients of the master's degree in 1951 | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | | In sanitary engineering work | | Out of sanitary engineering work | | Percent remaining in the profession |
| | Number | Percent | Number | Percent | Number | Percent | |
| Total | 874 | 100.0 | 763 | [1] 100.0 | 111 | 100.0 | 87.3 |
| Less than 1 | 415 | 47.5 | 331 | 43.4 | 84 | 75.7 | 79.8 |
| 1 to 4.9 | 255 | 29.2 | 232 | 30.4 | 23 | 20.7 | 91.0 |
| 5 to 9.9 | 126 | 14.4 | 123 | 16.1 | 3 | 2.7 | 97.6 |
| 10 to 14.9 | 57 | 6.5 | 56 | 7.3 | 1 | .9 | 98.3 |
| 15 to 19.9 | 17 | 1.9 | 17 | 2.2 | 0 | | 100.0 |
| 20 and over | 4 | .5 | 4 | .5 | 0 | | 100.0 |

[1] Because of rounding, details may not add to totals in this and all subsequent tables.

Since the majority earned their degrees rather recently, it is assumed that most of the graduates have remained in the same employment category in which they were prior to their graduate studies.

As a general rule, in those employment categories where the greatest use of master's level men has been made, a greater proportion of the men have returned to school to earn such a degree. However, there seem to be two exceptions to this rule. In the case of public works agencies where only a small proportion of sanitary engineers hold a master's degree, a high proportion have obtained them by returning to school after working in the field. With academic institutions, the opposite appears to be

**Table 4. Relationship between type of employment and pregraduate-school experience in sanitary engineering**

| Type of employment | Percent of all practicing sanitary engineers with a master's degree of any type [1] | Recipients of the master's degree in sanitary engineering | | |
|---|---|---|---|---|
| | | Number | Percent with 1 year or more of pregraduate-school experience | Median number of years of pregraduate-school experience |
| Total | | 874 | 52.5 | 1.35 |
| In sanitary engineering work | 21.3 | 763 | 56.6 | 1.88 |
| Public health agency | 35.8 | 345 | 68.1 | 3.32 |
| Public works agency | 11.2 | 66 | 59.1 | 2.33 |
| Utility company | 12.1 | 3 | 66.6 | 2.00 |
| Academic institution | 52.7 | 97 | 51.5 | 1.26 |
| Special agency [2] | 24.4 | 40 | 50.0 | 1.00 |
| Public administration | 10.8 | 6 | 50.0 | 1.00 |
| Construction firm | ([3]) | 16 | 50.0 | 1.00 |
| Industrial concern | 18.6 | 69 | 42.0 | .88 |
| Consulting firm | 12.9 | 107 | 34.6 | .77 |
| Other | 11.7 | 14 | 64.3 | 2.14 |
| Out of sanitary engineering work | | 111 | 24.3 | .66 |

[1] See reference 3.
[2] Includes professional associations, nongovernmental agencies, and military service.
[3] Included under "Other."

the case. Although a high proportion of educators and researchers hold the master's degree, relatively fewer of them gained experience before earning their degree. In some of the employment categories, the numbers involved were too small to produce significant information.

Sanitary engineers who return to school to earn their master's degree after having gained some experience seem to favor certain schools. The data show that significantly greater percentages of graduates from Harvard University and the University of Michigan have had more than 1 year of pregraduate-school experience. This also appeared to be the case (although not statistically significant) for the Johns Hopkins University, New York University, and the University of North Carolina. Conversely, a significantly smaller percent of the graduates from the University of Wisconsin and the Massachusetts Institute of Technology have had such experience. When the heavy producers are compared to the light producers, 57 percent of the graduates from the former are found to have had more than 1 year of pregraduate-school experience as compared to 30 percent of the graduates from the latter. This difference is significant.

### Time Spent in Sanitary Engineering

Because of the nature of sanitary engineering and particularly because of its relation to other types of public works, there are a number of graduates who spend only a portion of their time in sanitary engineering. This is particularly true for sanitary engineers who have reached a higher level of responsibility, such as the head of a large consulting firm, a city engineer, or the dean of a school of engineering. Table 5 shows this distribution, and compares it with that of the entire profession.

Four-fifths of the master's degree recipients in the sanitary engineering profession devoted most of their time to sanitary engineering work. When compared with the entire profession, the recipients of master's degrees in sanitary engineering devote considerably more of their time to work in sanitary engineering than do nonrecipients. This is probably so in part because the master's group is younger and because a greater proportion of this group is in public health work as compared with the profession as a whole.

**Table 5. Distribution of all sanitary engineers and of recipients of the master's degree by percent of time spent in sanitary engineering work**

| Group | Percent of time devoted to sanitary engineering work | All sanitary engineers [1] | Recipients of the master's degree in sanitary engineering | |
|---|---|---|---|---|
| | | Percent | Number | Percent |
| | Total | 100.0 | 763 | 100.0 |
| I | More than 75 | 61.9 | 611 | 80.1 |
| II | 50 to 75 | 19.2 | 82 | 10.7 |
| III | Less than 50 | 18.9 | 70 | 9.2 |

[1] See reference 3.

When we study the graduates from chronologically selected groups of classes, we find noteworthy differences in the percents remaining in, and in the distribution of percent of time spent on, sanitary engineering work.

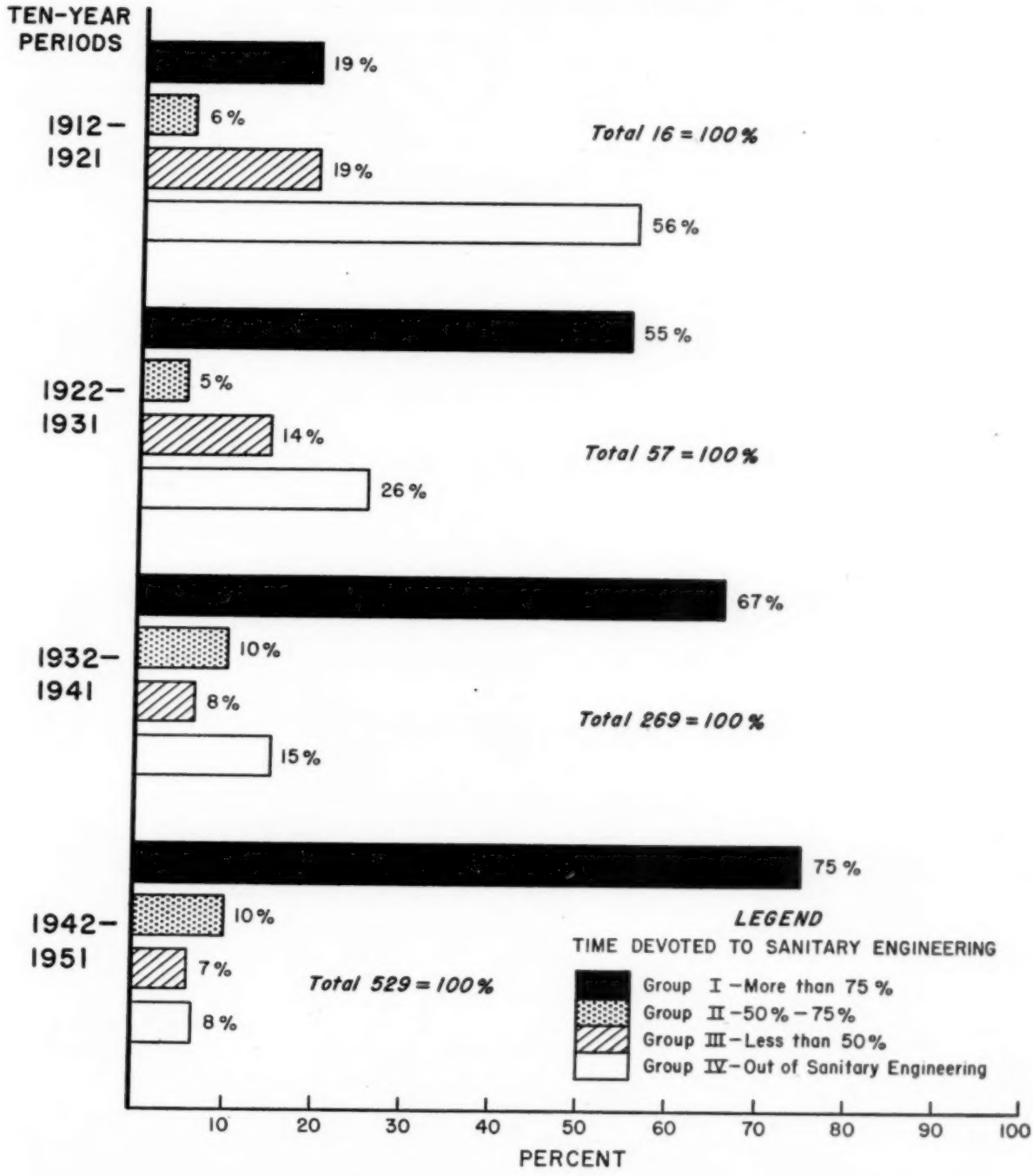
Figure 1 shows that the greater the time elapsed since graduation, the larger becomes the proportion of those who have left the profession. The high percentage of graduates from the 1912–21 classes who have left the profession is no doubt due in part to retirement. The progressive increase in the size of group I among the more recent graduates is probably due to the fact that younger men tend to work in more specialized areas and in part due to the recent expansion of environmental health activities in water pollution control and other fields.

How much of this change is due to program growth and how much of it can be attributed to the natural broadening of individual responsibility that comes with advancing professional experience can only be determined by periodic studies of this kind which will compare future observations with present findings.

### Employment Distribution

The types of employment favored by graduates of different colleges and universities appear to differ. To determine the extent of these differences, the graduates who have remained in

**Figure 1. Percentage distribution of recipients of a master's degree for selected 10-year periods, by time devoted to sanitary engineering work in 1951.**




the profession from each heavy producer school were compared in each case with the graduates from all the remaining schools combined by the type of employment in which they were found in 1951. It was possible to make these comparisons only for the heavy producers, as only they had graduates in sufficient numbers to justify significant conclusions.

Table 6 gives the employment information as of 1951 for the graduates of each of the 28 schools in the sample who were then in the profession.

**Table 6. Recipients of the master's degree in the profession in 1951, by institution and type of employment; and the percent remaining in the profession of the class group of 1942–51**

| Institution at which the master's degree was earned | Classes of 1900–1951 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | | Public health agency | | Public works agency | | Utility company | | Consulting firm | | Industrial concern | |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Total | 763 | 100 | 345 | 45.2 | 66 | 8.7 | 3 | 0.4 | 107 | 14.0 | 69 | 9.0 |
| Alabama Poly. Inst | 1 | 100 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ |
| California, Univ. of | 18 | 100 | 10 | 55.6 | 1 | 5.6 | 0 | ------ | 1 | 5.6 | 1 | 5.6 |
| Case Inst. of Tech | 5 | 100 | 1 | 20.0 | 0 | ------ | 0 | ------ | 3 | 60.0 | 1 | 20.0 |
| Cornell Univ | 13 | 100 | 5 | 38.5 | 1 | 7.7 | 0 | ------ | 2 | 15.4 | 1 | 7.7 |
| Florida, Univ. of | 11 | 100 | 5 | 45.5 | 1 | 9.1 | 0 | ------ | 0 | ------ | 0 | ------ |
| Harvard Univ | 297 | 100 | 160 | 53.9 | 17 | 5.7 | 0 | ------ | 38 | 12.8 | 30 | 10.1 |
| Illinois, Univ. of | 10 | 100 | 3 | 30.0 | 0 | ------ | 0 | ------ | 1 | 10.0 | 1 | 10.0 |
| Iowa State Col | 5 | 100 | 0 | ------ | 0 | ------ | 0 | ------ | 1 | 20.0 | 1 | 20.0 |
| Iowa, State Univ. of | 10 | 100 | 2 | 20.0 | 2 | 20.0 | 0 | ------ | 1 | 10.0 | 2 | 20.0 |
| Johns Hopkins Univ | 36 | 100 | 16 | 44.4 | 6 | 16.7 | 0 | ------ | 1 | 2.8 | 1 | 2.8 |
| Kentucky, Univ. of | 3 | 100 | 1 | 33.3 | 0 | ------ | 0 | ------ | 2 | 66.6 | 0 | ------ |
| Massachusetts Inst. of Tech | 55 | 100 | 13 | 23.6 | 3 | 5.5 | 0 | ------ | 15 | 27.3 | 6 | 10.9 |
| Michigan State Col | 5 | 100 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 1 | 20.0 |
| Michigan, Univ. of | 99 | 100 | 69 | 69.7 | 10 | 10.1 | 1 | 1.0 | 6 | 6.1 | 2 | 2.0 |
| New York Univ | 75 | 100 | 15 | 20.0 | 15 | 20.0 | 1 | 1.3 | 18 | 24.0 | 15 | 20.0 |
| North Carolina State Col | 3 | 100 | 1 | 33.3 | 0 | ------ | 1 | 33.3 | 0 | ------ | 0 | ------ |
| North Carolina, Univ. of | 40 | 100 | 18 | 45.0 | 2 | 5.0 | 0 | ------ | 8 | 20.0 | 2 | 5.0 |
| Northwestern Tech. Inst | 1 | 100 | 0 | ------ | 0 | ------ | 0 | ------ | 1 | 100.0 | 0 | ------ |
| Oklahoma Agri. and Mech. Col | 3 | 100 | 1 | 33.3 | 0 | ------ | 0 | ------ | 0 | ------ | 1 | 33.3 |
| Oregon State Col | 3 | 100 | 0 | ------ | 1 | 33.3 | 0 | ------ | 0 | ------ | 0 | ------ |
| Purdue Univ | 11 | 100 | 5 | 45.5 | 2 | 18.2 | 0 | ------ | 1 | 9.1 | 0 | ------ |
| Rensselaer Poly. Inst | 2 | 100 | 1 | 50.0 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ |
| Rutgers Univ | 1 | 100 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ |
| Tennessee, Univ. of | 1 | 100 | 0 | ------ | 1 | 100.0 | 0 | ------ | 0 | ------ | 0 | ------ |
| Texas, Univ. of | 7 | 100 | 3 | 42.9 | 2 | 28.6 | 0 | ------ | 1 | 14.3 | 0 | ------ |
| Virginia Poly. Inst | 16 | 100 | 5 | 31.3 | 1 | 6.3 | 0 | ------ | 2 | 12.5 | 1 | 6.3 |
| West Virginia Univ | 3 | 100 | 1 | 33.3 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ |
| Wisconsin, Univ. of | 29 | 100 | 10 | 34.5 | 1 | 3.4 | 0 | ------ | 5 | 17.2 | 3 | 10.3 |

See footnotes at end of table.

Harvard University, when compared to all other schools combined, has a significantly greater proportion of its graduates working for public health agencies and a significantly smaller proportion employed in public works agencies. Harvard also appears to have a smaller proportion of its graduates who have reached only the master's level serving as university teachers, although more than half of the Harvard doctorate recipients are now working in academic institutions.

Graduates from the University of Michigan also seem to choose, in smaller proportions than do graduates from the other schools combined, employment with consulting firms, industrial concerns, and academic institutions.

The picture among the graduates from New York University is somewhat reversed from that of the University of Michigan. Significantly smaller proportions are in public health and academic work, while significantly greater proportions are in public works agencies, consulting firms, and industrial concerns.

When the Massachusetts Institute of Technology was compared with all the other schools, it was found that a significantly small percent

**Table 6. Recipients of the master's degree in the profession in 1951, by institution and type of employment; and the percent remaining in the profession of the class group of 1942–51—Continued**

| Institution at which the master's degree was earned | Classes of 1900–1951 | | | | | | | | | | Classes of 1942–51 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Academic institution | | Special agency [1] | | Public administration | | Construction firm | | Other | | Remaining in the profession in 1951 |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Percent |
| Total | 97 | 12.7 | 40 | 5.2 | 6 | 0.8 | 16 | 2.1 | 14 | 1.8 | 91.9 |
| Alabama Poly. Inst | 0 | ------ | 0 | ------ | 0 | ------ | 1 | 100.0 | 0 | ------ | 100.0 |
| California, Univ. of | 4 | 22.2 | 0 | ------ | 0 | ------ | 1 | 5.6 | 0 | ------ | 90.0 |
| Case Inst. of Tech | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 36.4 |
| Cornell Univ | 3 | 23.1 | 0 | ------ | 0 | ------ | 1 | 7.7 | 0 | ------ | 85.7 |
| Florida, Univ. of | 4 | 36.4 | 1 | 9.1 | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Harvard Univ | 24 | 8.1 | 10 | 3.4 | 1 | .3 | 5 | 1.7 | 12 | 4.0 | 94.4 |
| Illinois, Univ. of | 4 | 40.0 | 1 | 10.0 | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Iowa State Col | 3 | 60.0 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 66.7 |
| Iowa, State Univ. of | 3 | 30.0 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 80.0 |
| Johns Hopkins Univ | 3 | 8.3 | 8 | 22.2 | 0 | ------ | 1 | 2.8 | 0 | ------ | 97.2 |
| Kentucky, Univ. of | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Massachusetts Inst. of Tech | 11 | 20.0 | 3 | 5.5 | 2 | 3.6 | 1 | 1.8 | 1 | 1.8 | 97.6 |
| Michigan State Col | 4 | 80.0 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Michigan, Univ. of | 5 | 5.1 | 4 | 4.0 | 0 | ------ | 2 | 2.0 | 0 | ------ | 95.2 |
| New York Univ | 3 | 4.0 | 7 | 9.3 | 0 | ------ | 1 | 1.3 | 0 | ------ | 87.9 |
| North Carolina State Col | 1 | 33.3 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 66.7 |
| North Carolina, Univ. of | 5 | 12.5 | 3 | 7.5 | 1 | 2.5 | 0 | ------ | 1 | 2.5 | 96.7 |
| Northwestern Tech. Inst | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 50.0 |
| Oklahoma Agri. and Mech. Col | 1 | 33.3 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Oregon State Col | 2 | 66.6 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Purdue Univ | 1 | 9.1 | 2 | 18.2 | 0 | ------ | 0 | ------ | 0 | ------ | 91.7 |
| Rensselaer Poly. Inst | 1 | 50.0 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Rutgers Univ | 1 | 100.0 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | [2] |
| Tennessee, Univ. of | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Texas, Univ. of | 1 | 14.3 | 0 | ------ | 0 | ------ | 0 | ------ | 0 | ------ | 100.0 |
| Virginia Poly. Inst | 4 | 25.0 | 1 | 6.3 | 1 | 6.3 | 1 | 6.3 | 0 | ------ | 83.3 |
| West Virginia Univ | 1 | 33.3 | 0 | ------ | 1 | 33.3 | 0 | ------ | 0 | ------ | [2] |
| Wisconsin, Univ. of | 8 | 27.6 | 0 | ------ | 0 | ------ | 2 | 6.9 | 0 | ------ | 77.8 |

[1] Includes professional associations, nongovernmental agencies, and military service.
[2] No master's degree in sanitary engineering granted in the 1942–51 period.

of its graduates are in public health agencies and a significantly greater percent with consulting firms. MIT graduates also appear to favor employment in academic institutions.

The employment distribution of the graduates from the University of North Carolina appears to fall closer to the average than that of the other heavy producers. There were no significant differences in the employment distribution of its graduates when they were compared with those of the other schools.

Graduates from the Johns Hopkins University showed an employment distribution fairly close to the average except that they favor public works agencies somewhat and are represented in a significantly smaller proportion in consulting firms.

The University of Wisconsin is the only school which has a significantly higher proportion of its graduates employed in academic institutions.

When heavy and light producers were compared, a few differences were found in the employment distribution of the graduates from the two groups of schools. The heavy producers had a significantly higher proportion of their

graduates employed in public health agencies and the light producers had almost three times as great a proportion of their graduates employed in academic institutions as did the heavy producers. As a matter of fact, more than half of those employed in the academic field came from the light producers and, interestingly enough, the University of Wisconsin, which produced the least number of graduates among the heavy producers, also had a high percentage of its graduates teaching.

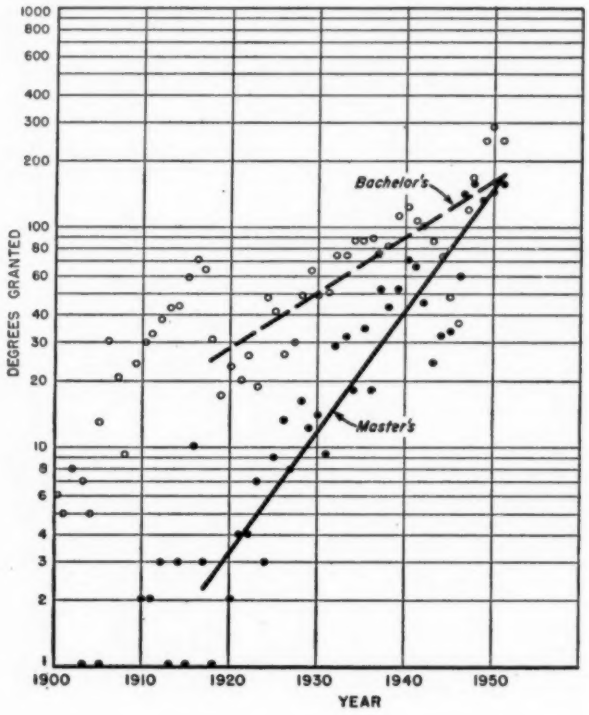
If these data are pursued further, it becomes evident that only a small proportion (15.3 percent) of the master's degree recipients from the heavy producers who are now in the academic field, are teaching at the same institution that awarded them their master's degrees. But of more importance, these data also reveal that the light producers not only turn out a disproportionate share of teachers, but that the majority of these teachers (64.3 percent) have remained with the same institution from which they earned graduate degrees. It is likely that the Engineer's Council for Professional Development (see its 19th annual report, 1951) had this in mind when it wrote: "As schools grow, the pressure for staff expansion led to recruiting by the simple process of keeping on recent graduates, and then allowing them to do their graduate work, if any, while teaching. In this way, there was a subtle influence of continuity of curriculum with little urge for reevaluation or vitality of concept of objectives."

### Growing Importance of the Master's Degree

While there has been a considerable increase in the number of sanitary engineering degrees granted on all levels, the number of master's degrees has increased at a greater rate than the number of bachelor's degrees.

The total number of master's and bachelor's degrees granted to students majoring in sanitary engineering in the United States each year during the period 1900–1951 are shown in figure 2. The points on this figure have been plotted on a logarithmic vertical scale in order to facilitate the comparison of relative differences. Between the years 1917 and 1941, the data appear to assume a certain degree of linearity (see note on page 727).

**Figure 2. Total number of bachelor's degrees and of master's degrees granted upon completion of study in sanitary engineering in the United States each year, 1900–1951.**




The figure shows that the average rate of increase in the annual number of master's degrees granted has been considerably greater than that of the bachelor's degrees. The two curves intersect during 1951. This is, of course, not true for the entire engineering field.

Although there is no evidence that sanitary engineering education on the undergraduate level is on the decline, there is a definite shift of emphasis toward graduate level education in this field. Educational opportunities for veterans have undoubtedly been partly responsible for this shift.

Future trends in a field as small as this are difficult to predict. Recent estimates (*1*) of the expected number of graduates from the bachelor's level appear now to have been somewhat low. This is because the estimates of future production of all engineering graduates were recently raised, presumably because of the effect of the recent publicity on the shortage of engineering manpower. It looks now as though we might expect between 500 and 600 sanitary engineering graduates at the bachelor's level

NOTE: When a straight line is fitted to the points by the method of least squares for the period 1917–51 (see fig. 2 and p. 726 of text), the mathematical expressions for the best fitting lines became:

$$\text{Log } Y_{cb} = 1.77780 + .02777x \text{ for the bachelor's degrees and}$$
$$\text{Log } Y_{cm} = 1.28388 + .05654x \text{ for the master's degrees.}$$

x equals the year minus 1934 during which $Y_c$ degrees were granted. The year 1934 was chosen as the origin for the x-axis.

during the 4-year period, 1953–56. Figure 2 indicates that if the 34-year (1918–51) trend continues, the annual number of master's degrees granted may be expected to exceed the number of bachelor's degrees.

The availability of public, philanthropic, and other funds for graduate education, as well as selective service policies and general economic trends, are each likely to have an impact upon the number of men who will be able to earn master's degrees in sanitary engineering in the years to come. No matter what outside forces might introduce unexpected change, the record of the past 34 years clearly shows the profession's increasing preference for graduate training in the structure of sanitary engineering education.


## Summary

A quantitative study has been made of those who received master's degrees in sanitary engineering during the 52-year period 1900–1951. Twenty-eight colleges and universities, whose graduates represent 86 percent of all the United States nationals who received master's degrees in sanitary engineering during that period, were included in the study. Upon inquiry, 85.4 percent of these graduates responded with usable data.

It was found that 87.3 percent of the master's degree recipients were in the profession in 1951.

The median master's degree recipient gained 1.35 years of sanitary engineering experience after receiving his bachelor's degree and before beginning his graduate studies. Of the entire group, only 3 percent who had had pregraduate-school experience, left the profession at sometime subsequent to doing graduate work.

Among the master's degree recipients reporting, 83.6 percent earned their degrees at 7 of the schools (heavy producers) and 16.4 percent, at the other 21 schools (light producers). A significantly greater proportion of graduates from the heavy producers than from the light producers were practicing sanitary engineering in 1951.

The patterns of employment distribution of the graduates from certain individual schools and from the heavy and the light producer groups differ in part significantly from each other. Particularly outstanding is the fact that more than half of those in the academic field have received their degrees from the light producers and almost two-thirds of them are employed at the institution in which they received their master's degree.

Slightly more than one-third of those who received the master's degree in sanitary engineering had a sanitary engineering undergraduate education. About half took the civil engineering curriculum and one-sixth had completed undergraduate work in one of the other branches of engineering.

The relative trends in the production of bachelor's and master's level graduates in sanitary engineering over the past 34 years suggest that the point has been reached at which the annual production of master's level graduates can be expected to exceed that of the bachelor's level graduates. This observation, together with the fact that roughly 8 out of 10 master's degree recipients as compared with 5 out of 10 bachelor's degree recipients, stay in the profession for which they received their schooling suggests that the educational needs of the profession are being more successfully met by graduate-level education.

**ACKNOWLEDGMENT**

The authors are appreciative of the advice on statistical problems given by Theodore D. Woolsey, biostatistician, Division of Public Health Methods, Public Health Service.

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## Public Health Service Staff Announcements

**Dr. Russell M. Wilder,** first director of the National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, Public Health Service, retired July 1, 1953. Dr. Wilder, internationally known for his work in metabolic diseases and nutrition, came to the Public Health Service in January 1951 shortly after his retirement from the Mayo Foundation where he was professor of medicine and chief of the department of medicine. He will continue as a member of the Board of Editors of *Public Health Reports*. Dr. Wilder will make his home at Rochester, Minn.

**Dr. Eddie M. Gordon** has been appointed medical officer in charge of the Public Health Service Hospital (National Leprosarium), Carville, La., to succeed Dr. Frederick A. Johansen. Dr. Gordon has been in charge of the Public Health Service Hospital in Chicago. He has also held clinical positions at the Service medical facilities in San Francisco, Boston, Seattle, and San Pedro, and has been assigned medical officer in the U. S. Consulates at Hong Kong, China, and Manila, P. I.

**Dr. Frederick A. Johansen,** who retired June 1 after 29 years of service at Carville, participated actively in the evolution of the modern sulfone therapy. Later he guided the installation and organization of the community activities and rehabilitation services at the National Leprosarium. He is widely recognized as an authority on Hansen's disease.

**Octavia Heistad,** Public Health Service nurse officer, has been assigned to the Point IV technical aid program in Libya where she will work with Libyan nurses and other health aides in extending public health nursing. Miss Heistad, who has done public health nursing in Chicago and Detroit for the past 4 years, will join Bertha Tiber, assigned to Libya as chief nurse under Point IV.

# Rapid Method For Distilling Fluorides From Water Samples

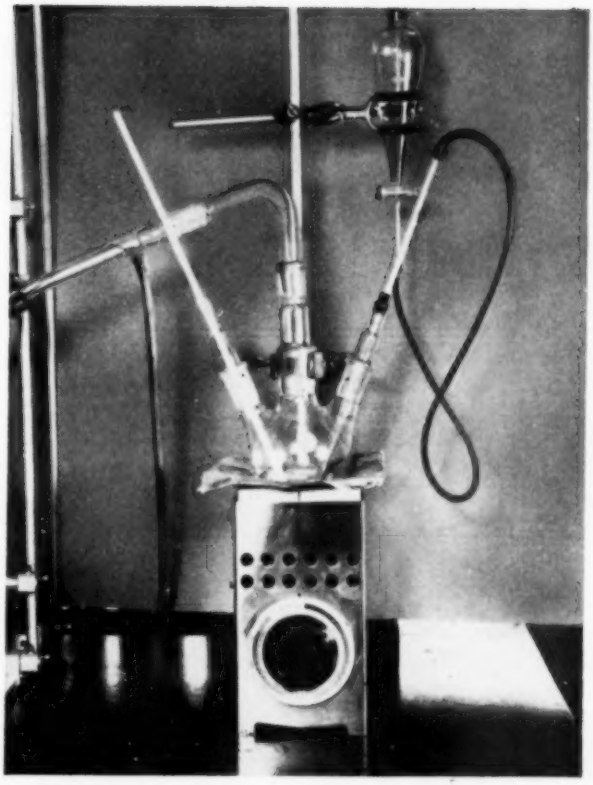
By R. E. Frazier and H. G. Oldfield, M.S.

Distillation of fluorides from water samples, when concentration of the sample is unnecessary, may be made in less than 30 minutes, one-third of the time required for distillation by the standard method, by simply introducing the sample itself at a slow constant rate into a mixture of water and sulfuric acid kept boiling at a temperature of 140° C. Where frequent fluoride distillations are required, the timesaving features of this method make it particularly useful.

The method described here evolved from the logical supposition that with a constant distillation rate and temperature and with fluoride entering the flask in the sample water and leaving the flask in the distillate, the concentration of the fluoride in the distillate would eventually be the same as the concentration in the sample. The rate of distillation might have a slight effect on the point at which equilibrium is attained, but equilibrium must be reached at some point as long as the rate is constant.

## Distilling Apparatus

The distilling apparatus used in the experimental work to be described is shown in the acompanying illustration. The flask is a 500-ml. three-necked boiling flask fitted with a thermometer which extends into the liquid being distilled. The sample lead-in tube is a 0.1-ml. pipette connected to a separatory funnel by a length of rubber tubing and fitted into one neck of the flask by means of a rubber sleeve. All other joints are standard taper glass. The separatory funnel has a notched stopcock for easy control of flow at slow rates; a glass tube fitted in a rubber stopper reaches nearly to the bottom of the funnel to provide a constant head of liquid. The heating unit is a 750-watt heater with transformer control.



**Distillation apparatus used in experimental work on rapid method for distilling fluorides.**

## Procedure

The flask is charged with 15 ml. of sulfuric acid, glass beads, a small amount of silver sulfate, and sufficient water to give a boiling point of 138° to 140° C.

In making a distillation, the sample is introduced at a rate sufficient to maintain a temperature of 138° to 140° C. with the heating unit set at full capacity. With the apparatus described, distillation proceeds at the rate of approximately 7 ml. per minute. All tests described below are based on a distillation rate of 7 ml. per minute at 138° to 140° C.

At the end of one distillation, the excess sample in the separatory funnel is discarded and a new sample introduced, the lead-in tube to the flask being removed and flushed with the new

*Mr. Frazier is chief and Mr. Oldfield is bacteriologist of the engineering laboratories section, division of environmental sanitation, Minnesota Department of Health.*

sample. The separatory funnel and lead-in tube are again placed in position, and the distillation is restarted. The acid charge in the flask may be used repeatedly. As many as 20 distillations from one batch of acid have been made with no apparent difficulty. The frequency of acid renewal should probably depend upon the mineral and organic-matter content of the water analyzed.

### Equilibrium Studies

Preliminary experiments were made with a known concentration of fluoride in distilled water in order to determine how rapidly equilibrium between input and output would be established. One hundred milliliters of distilled water were distilled through the apparatus and discarded. Then a solution containing 2 ppm fluoride was distilled, and five 50-ml. portions were collected. Distillation of the fluoride solution was discontinued and distilled water substituted, five 50-ml. portions again being collected.

The fluoride content of the portions collected and of all subsequent samples described in this report was determined by the Sanchis method, modified by Scott, as outlined in "Standard Methods for the Examination of Water and Sewage," ninth edition. Analysis of these samples gave the results in table 1, which indicate that for routine work distillation of 50 ml. to waste at the beginning of each new sample should be sufficient.

In order to determine whether or not equilibrium would be established at a similar rate with tapwater, fluoride was added to Minneapolis tapwater at the rate of 1.5 ppm. The apparatus was cleared of fluorides by distilling 300 ml. of distilled water through it. Then distillation of the fortified Minneapolis water was started, and four consecutive 50-ml. portions were collected. Results of the analysis of these portions, shown below, again indicate that for routine work a sufficiently adequate equilibrium is established after the distillation of 50 ml. to waste.

**Table 1. Recovery of fluoride in successive 50-ml. portions**

| Portion No. | Concentration in feed (ppm) | Concentration in recovered distillate (ppm) |
|---|---|---|
| 1 | 2 | 1.5 |
| 2 | 2 | 2 |
| 3 | 2 | 2 |
| 4 | 2 | 2 |
| 5 | 2 | 2 |
| 6 | 0 | .7 |
| 7 | 0 | .02 |
| 8 | 0 | Trace |
| 9 | 0 | 0 |
| 10 | 0 | 0 |

| *Portion No.* | *Concentration in recovered distillate (ppm)* |
|---|---|
| 1 | 1.00 |
| 2 | 1.56 |
| 3 | 1.58 |
| 4 | 1.59 |

Another series of experiments was made with Minneapolis tapwater to determine whether or not the distillation of 50 ml. to waste before collecting a sample would be sufficient for samples with a higher fluoride concentration. After the apparatus was cleared with distilled water, four successive 50-ml. portions were collected from distillate of Minneapolis tapwater containing 5 ppm added fluoride. Results of the analysis of these portions, shown below, indicate that equilibrium is established at approximately equal rates for samples containing about 1.5 ppm and 5 ppm fluoride.

| *Portion No.* | *Concentration in recovered distillate (ppm)* |
|---|---|
| 1 | 3.75 |
| 2 | 4.80 |
| 3 | 5.0 |
| 4 | 5.0 |

### Accuracy Tests

Further experiments with tapwater were made to determine the general accuracy of the procedure as it would actually be used. Samples of Minneapolis tapwater containing 1.5 ppm added fluoride were alternated with samples of Minneapolis tapwater containing only the naturally occurring fluorides, 50 ml. of distillate being discarded at the beginning of each change. Both the distilled samples and the undistilled samples were analyzed by the standard method. Results of these tests, shown

**Table 2. Recovery of fluoride from Minneapolis water—normal and fortified samples**

| Portion No. | Fluoride added (ppm) | Fluoride recovered (ppm) | |
|---|---|---|---|
| | | Distilled | Not distilled |
| 1 [1] | 0 | 0.11 | 0.15 |
| 2 | 0 | .12 | |
| 3 | 0 | .11 | |
| 4 [1] | 1.5 | 1.58 | 1.6 |
| 5 [1] | 0 | .10 | |
| 6 [1] | 1.5 | 1.54 | |
| 7 [1] | 0 | .13 | |
| 8 [1] | 1.5 | 1.56 | |

[1] 50 ml. of distillate discarded before collecting sample.

in table 2, indicate that the technique is sufficiently accurate for routine work.

### Other Substances Added

It has been reported that aluminum may cause irregularity in the recovery of fluorides by distillation. Although waters in Minnesota usually contain less than 0.5 ppm aluminum, it was decided to investigate the effect of added aluminum. Test solutions were made by adding 1.5 ppm of fluoride and 10 ppm of aluminum to Minneapolis tapwater. Two hundred and fifty milliliters of this solution were distilled, the first 50 ml. being discarded and two successive 100-ml. portions collected. Then, 250 ml. of Minneapolis water containing 1.5 ppm of added fluoride were distilled, the first 50 ml. again being discarded and two 100-ml. portions collected. The results of the analysis of these samples are tabulated in table 3. There appears to be little or no effect on fluoride recovery either during the time the aluminum was being added or on samples distilled after 2.5 milligrams of aluminum had accumulated in the flask.

**Table 3. Fluoride recovery from Minneapolis water in presence of aluminum**

| Portion No. | Aluminum added (ppm) | Fluoride added (ppm) | Fluoride recovered (ppm) |
|---|---|---|---|
| 1 [1] | 0 | 1.5 | 1.56 |
| 2 [1] | 10 | 1.5 | 1.56 |
| 3 | 10 | 1.5 | 1.58 |
| 4 [1] | 0 | 1.5 | 1.60 |
| 5 | 0 | 1.5 | 1.54 |

[1] 50 ml. of distillate discarded before collecting sample.

A similar experiment was made to determine the effect of dissolved silica on the distillation. Minneapolis water with 1.5 ppm added fluoride was distilled alternately with Minneapolis water containing 1.5 ppm added fluoride and 20 ppm added silica. The dissolved silica content of the original Minneapolis water was found to be 6 ppm by the molybdate colorimetric determination. Results of this experiment appear in table 4. No significant differences were found in fluoride recovery.

**Table 4. Effect of silica on recovery of fluorides from Minneapolis water**

| Portion No. | Fluoride added (ppm) | Silica added (ppm) | Fluoride in distillate (ppm) |
|---|---|---|---|
| 1 [1] | 1.5 | 0 | 1.56 |
| 2 | 1.5 | 0 | 1.56 |
| 3 [1] | 1.5 | 20 | 1.54 |
| 4 | 1.5 | 20 | 1.56 |
| 5 [1] | 1.5 | 0 | 1.56 |
| 6 [1] | 1.5 | 20 | 1.56 |
| 7 | 1.5 | 20 | 1.56 |
| 8 [1] | 1.5 | 0 | 1.56 |

[1] 50 ml. of distillate discarded before collecting sample.

### Conclusion and Summary

The distillation method outlined, which requires less than 30 minutes, appears to be sufficiently accurate for routine work. Equilibrium studies have shown that at a distillation rate of 7 ml. per minute and a temperature of 138° to 140° C., distillation of 50 ml. to waste at the beginning of each new sample is sufficient. The addition of aluminum and of dissolved silica to the test samples does not appear to affect significantly the recovery of fluoride from the distillate.

## *In Departmental Periodicals . . .*

### OCCUPATIONAL HEALTH

#### Training of Health Workers In Los Angeles Program

In the June 1953 issue of Occupational Health, Jack C. Rogers notes that public health personnel have generally refrained from entering the field of industrial hygiene.

The occupational health services in Los Angeles have been confined to the division of occupational health (which Mr. Rogers directs) in the city health department. To compensate for the manpower shortage within the division and still provide adequate health services throughout the city's sprawling area, other departmental personnel are being brought into the industrial health program. This is being achieved with the cooperation of the other administrative units of the city health department.

As a result of the program, sanitarians and public health nurses are getting training and technical guidance in their jobs from the division of occupational health. Similarly, sanitarians are training industrial hygienists in industrial sanitation. Public health nurses are being trained to act as contacts between industry and the division of occupational health. Both are being alerted to spot and report to the health department the occupational hazards they uncover.

Mr. Rogers points out that by the actual designation of the occupational health division as the one unit of the department which is responsible for all contact with industry, the danger of overlapping or conflict in plant inspections or in instructions is eliminated. The division thereby handles all matters involving industry from those problems normally assigned to the occupational health program to those connected with water supplies, cross connections, industrial wastes, and others.

#### Michigan Training Program In Industrial Hygiene

The need for the control and prevention of occupational disease was recognized as early as 1875 in Michigan, according to John C. Soet, chief of Michigan's division of industrial health. The entire field of official industrial hygiene is faced with the twofold problem of keeping the small total of experienced personnel at its present level and of having some satisfactory source of replacement.

Finding that its entrance requirement of a year's experience in industrial health was losing potential candidates for careers in industrial health, the Michigan Department of Health now offers a training program for graduate engineers and other qualified applicants. This program is designed particularly to attract graduates in chemical engineering to the profession of public health engineering.

The training program combines field work with classroom and lecture sessions over a 23-week period. It now includes a special ventilation conference at Michigan State College, special industrial health conferences at the Michigan School of Public Health and will include the radiological health course offered by the Public Health Service. Trainees do not assume any real responsibility for the first 2 years but work under the supervision of experienced men.

"Our statistics show that over the years the vast majority do remain in industrial hygiene," Mr. Soet stated, adding that, on the average, the trainees remained for a long period of time—long enough to repay the cost of training.

#### Suspension Notice

Publication of *Occupational Health*, a monthly since 1940, has been suspended with its July 1953 issue as the result of reduction in appropriations. However, *Public Health Reports*—which in recent issues has presented papers on air pollution, human relations in industry, occupational and environmental aspects of various diseases, and industrial dentistry—will give increased attention to technical topics in occupational health. Official agencies, professional organizations, and teaching institutions not now receiving *Public Health Reports* should inquire of the Public Health Service as to their eligibility for official or free subscriptions. Other groups—and individuals wishing personal copies—should purchase subscriptions. *Use the subscription blank on the inside back cover of this issue.*

Recent issues of *Occupational Health* are available at 10¢ a copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

# *Legal Notes*
## *on public health*

# Constitutionality of Delegation of Legislative Powers To State Boards of Health

The provisions of the Arizona State Sanitary Code which were applicable to agricultural labor camps were declared void, and the provisions of an Arizona statute on which the code is based were held to be an unconstitutional delegation of legislative power by the Supreme Court of Arizona on January 15, 1953—*State of Arizona* v. *Marana Plantations*, 252 P. (2) 87 (1953).

The Arizona statute authorized the Arizona State Board of Health to "formulate general policies affecting the public health," to "regulate sanitation and sanitary practices in the interests of public health," and to "protect and promote public health and prevent disability and mortality."

The court's decision was based on the ground that the statute permits the Arizona State Board of Health to issue "such sanitary laws as its unrestrained discretion may dictate" without statutory guides or criteria.

Pursuant to the statute the Arizona State Board of Health had adopted regulations governing health aspects, water supply, toilets, bathing facilities, housing, fire protection, and garbage disposal at agricultural labor camps. The board of health had charged the defendant, Marana Plantations, with violating these regulations, and the defendant had challenged the basic authority of the board to issue them.

The scope of the police power of States as it relates to health has been succinctly stated by the Supreme Court of Appeals of West Virginia in *Hayes* v. *The Town of Cedar Grove*—126 W. Va. 828, 30 SE 2d 726, 731, 156 ALR 702 (1944):

"So far as we know, the power of the State, under its police power, to provide for the health of its people, has never been questioned, but on the contrary, has been stressed as one of the powers which may be given the broadest application; and it is common knowledge that this power has been increasingly exercised, in keeping with advances made in the sciences of medicine and sanitation, in recent years. In these circumstances, courts are reluctant to place limits on what may be done in the interest of the health of a community, so long as unreasonable methods are not employed, nor the natural and constitutional rights of citizens invaded.

"The police power of the State is vested in the legislative branch of our Government, and may be employed or delegated by it, subject only to the control of the courts, to the extent that they may properly act."

Delegations of authority in broad terms to State boards of health to make regulations having the force of law for the protection of public health and for the prevention of disease have generally been upheld by the courts. (See 25 Am. Jur. 287, note 2; 79 L. Ed. 523.) The stricter rule applied in some States, such as Arizona, requires more specific statutory criteria and should be carefully considered when preparing health legislation intended for enactment by the legislatures.

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*This note has been prepared by the Public Health Division, Office of the General Counsel, Department of Health, Education, and Welfare.*

# publications

## Educational Materials on Water Pollution Control.

Public Health Service Publication No. 256. 1953. 2-fold leaflet. Division of Water Pollution Control, Public Health Service, Washington 25, D. C.

Exhibits, posters, films, and publications may be obtained through Federal and State water pollution control agencies for use by local organizations and groups to aid in the fight to make America's waters safe and clean. Every community needs to feel its responsibility in making and keeping its own water resources clean for drinking and domestic use, for raising crops and livestock, and for recreation uses.

This leaflet contains illustrations and descriptions of the educational materials available to use in the community's fight for clean water. It tells where to send for the items best suited to a specific program for water pollution control.

## Basic Drugs—U. S. Public Health Service Hospitals and Clinics.

Public Health Service Publication No. 246. 1953. 165 pages. 50 cents.

The Division of Hospitals, Bureau of Medical Services, Public Health Service, has prepared a handbook of basic drugs for the division's 18 hospitals and 22 outpatient clinics. The handbook is intended as the beginning rather than the arbitrary end in drug therapy. The primary criterion is therapeutic efficacy—selection of the best, the simplest, the fewest, and the safest medicines currently needed in the prevention, diagnosis, and treatment of illnesses. Preference is given to U. S. Pharmacopeia, the National Formulary, New and Nonofficial Remedies, and Accepted Dental Remedies items.

Unnecessary duplication is avoided in the handbook. Drugs with secret composition are not considered, and mixtures are included only when they provide substantial advantage over the individual components.

However, "nonbasic" drugs which prove to have a high rate of acceptance by the individual division stations will eventually be added to the list of "basic" drugs in future revisions. The handbook further recommends the rapid and extensive adoption of meaningful, standard drug terminology and the metric system.

The philosophy, objectives, and application of this manual in a general program of maintaining sound drug therapy were presented in an article, "An Objective Approach to Drug Therapy," published in the January 1953 issue of *Public Health Reports*.

## Clean Water in the Arkansas, White, Red, and Lower Mississippi Valleys.

Public Health Service Publication No. 252. 1952. 6 pages; illustrations. 5 cents.

It pays to prevent water pollution. Damage to water resources from the wastes discharged by our growing cities and industries can be controlled. The publication cites experiences of several cities of the southwest-lower Mississippi area which were compelled to find new water supply sources because the rivers flowing through or near the cities became polluted. Questions asked are: What happens if the new sources get polluted? Do we go to still more distant ones? Suppose all our public waters except those too small or remote for use get polluted, what then?

Reference is made to a State-Federal report on water pollution in the Arkansas area which lists more than 500 cities as needing some kind of facility for waste treatment. The total cost of those facilities is estimated at $50 million, but divided among the cities and financed over a period of years, the cost to each family in the community will be no more than a few cents a day. This, the booklet states, is little enough to pay in return for abating an evil that endangers health, spoils water for industrial and agricultural use, kills fish and wildlife, ruins recreational areas, and is undermining the very foundation of our highly urbanized and industrialized American way of life.

## Let's Have Clean Water.

Kit of materials to aid community leaders in their efforts to solve local water pollution problems. Public Health Service Publication No. 264. 1952. 5 parts. $1.25 per kit.

Theodore Roosevelt said, "The Nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased; and not impaired in value." Water pollution in this country is a constant threat which must be controlled if we are to maintain an adequate supply of safe, clean water for home, for agriculture, for industry, and for recreation.

In order to increase the general awareness of the need for pollution control and to aid communities in developing their own control programs, the Division of Water Pollution Control has prepared this kit of materials designed for local leaders of civic clubs, women's clubs, sportsmen's groups, and the like. Included in the kit are a series of six background readings entitled "The Living Waters," covering the uses of water and the importance of pollution control. A "Chairman's Guide" gives suggestions on discussion techniques and on the use of motion pictures, panel discussions and speakers in local meetings, and provides sources of information for community leaders, including the names of all State water pollution control agencies.

Three publications issued earlier have been incorporated into the kit: "The Fight To Save America's Waters," a story of public health and conservation featuring the familiar comic strip character, Mark Trail. "Clean Water Is Everybody's Busi-

ness" presents a graphic review of the water pollution problem and how it affects various aspects of our daily lives. The third publication, "Water Pollution in the United States," gives a more detailed description of the water pollution problem, and a discussion of the costs and responsibilities for control programs.

## A Bibliography of Toxoplasmosis and *Toxoplasma Gondii*.

By D. E. Eyles and J. K. Frenkel. Public Health Service Publication No. 247. 1952. 47 pages. 20 cents.

Toxoplasmosis has been recognized as a human disease for little over a decade; it is therefore possible for the interested researcher to become acquainted with most of the published material on the subject. The authors of A Bibliography of Toxoplasmosis and *Toxoplasma gondii*, who have had occasion to study the literature and have collected reprints, photoprints, or translations of most of the papers, have covered the literature through 1951. A few 1952 papers are included. The earliest paper cited is by Laveran—the date, 1900. This was followed in 1913 and 1915 by other papers by the same author, but 20 years elapsed before more than an occasional paper appeared in the literature. The bibliography contains 920 titles.

In their preface, the authors state that because of time limitations, it was not possible to be critical in selecting titles. Some papers dealing with organisms erroneously assigned to *Toxoplasma* by their authors are included, and there are references to a few case reports in which the evidence that *Toxoplasma* was involved is scant or poor. A number of papers which do not refer to *Toxoplasma* are included as they are now considered to deal with this organism.

In preparing the bibliography, full citations are given if the information is available, and references to abstracts have been listed with the citation of the original whenever possible.

## Milk Ordinance and Code. 1953 Recommendations of the Public Health Service.

Public Health Service Publication No. 229. 1953. 242 pages. 75 cents.

The twelfth revision since 1924, the 1953 edition of the Milk Ordinance and Code recommended by the Public Health Service takes cognizance of the notable progress in milk sanitation since 1939.

Like the preceding editions, this revision has been developed with the assistance of the U. S. Department of Agriculture, the Food and Drug Administration, State health and agriculture departments, local health departments, the dairy industry, educational institutions, and individual milk sanitarians.

The book is presented in a form which can be adopted as an ordinance or other legal instrument. Part I contains an abridged form of the recommended milk ordinance suggested for local adoption in States where adoption of ordinances by reference to published standards is considered legal. The Council of State Governments has prepared a model law, "Milk and Food Codes Adoption Act," published in "Suggested State Legislation Programs for 1950."

Part II is the complete ordinance. It details the definition of milk and milk products, the issuing of permits, standards for labeling, inspection, examination, grading, and grades of milk. Section 11 regulates milk and milk products from points beyond the limits of routine inspection.

Part III contains the interpretative code, which together with part IV is to be used as the legal interpretation of the ordinance. It repeats the provisions of part II and gives the reasons for each requirement.

Part IV consists of nine appendixes containing detailed explanatory material and standards formerly used in the code, but now transferred to provide a condensed reference to essential detail not routinely used. The appendixes are an integral part of the code.

On several major and minor questions, the ordinance offers two or more choices. A "degrading" and a "nondegrading" form for enforcement are given. Among other items of choice are: use of reduction tests instead of plate or direct microscopic counts where suitable laboratory facilities cannot be provided; use of a compliance standard of 3 out of 4 samples rather than logarithmic or arithmetic averages of 4 samples.

The Public Health Service is cooperating in a voluntary program of certification of interstate milk shippers. The model ordinance discourages the use of public health regulations to establish unwarranted barriers against acceptance of high-grade milk from other milksheds.

The program of interstate milk certifications was supported by the Committee on Agriculture and Forestry of the United States Senate which "strongly recommended that the Milk Ordinance and Code of the Public Health Service should be used as the minimum standard for the sanitary rating and acceptance of interstate milk shipments."

## Home Accident Prevention—A Guide for Health Workers.

Public Health Service Publication No. 261. 1953. 75 pages. Information concerning the availability of this publication can be obtained from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

Accidents in the home in 1951 accounted for an estimated total of 28,000 deaths, 110,000 individuals permanently disabled, and 4,200,000 persons temporarily disabled. Because this loss of manpower and the drain upon medical facilities can be prevented, the public health profession is being called upon to take the leadership in developing home accident prevention programs.

In response to numerous requests from educators for assistance in introducing home accident prevention

# publications

materials in the training of professional public health workers, this booklet has been prepared as a guide for discussion of the problem.

In 13 sections, this publication outlines the chief problems of home accident control, the major causes of home accidents, and recommended preventive measures. The major causes of accidents covered are: falls, fire, hot surfaces and hot liquids, poisons, gases, toxic vapors, and insecticides, electricity, cutting and piercing instruments, firearms, and lifting, carrying, and lowering. In addition, there are outlines for discussion of the general problem, the epidemiological aspects of accidents, environmental hazards, and human and age factors. Selected references and lists of visual aids are contained in the appendixes.

## Cancer Illness Among Residents of Philadelphia, Pa.

Cancer Morbidity Series No. 10, Public Health Service Publication No. 244. 1952. 43 pages; tables, charts. Individual copies available on request to National Cancer Institute, Public Health Service, Bethesda 14, Md.

This publication, the tenth and last of the Cancer Morbidity Series, reports that, as in most of the other cities studied, cancer is apparently increasing among the residents of Philadelphia, Pa.

According to a survey made in 1948, the incidence rate for cancer was 26 percent greater than in 1938, while the prevalence rate was up 21 percent. The greatest increase noted was for cancer of the bronchus and lung, for which the incidence rose 101 percent in the 10-year period.

Approximately half of the cancer cases diagnosed in 1948 were discovered while localized at the site of origin; 2 out of 10 were not diagnosed until remote tissues had become involved. The fact that less than two-fifths of breast cancer cases—an accessible site—were diagnosed while localized points to the need for improvement in case-finding techniques for accessible as well as inaccessible sites, the report indicates.

The first nine studies in the Cancer Morbidity Series covered the Atlanta, New Orleans, San Francisco, Denver, Pittsburgh, Chicago, Dallas, Birmingham, and Detroit areas. A summary containing geographic comparisons, interpretations of apparent national trends, and special analyses will be issued at a later date.

## Small Plant Health and Medical Programs.

By Margaret C. Klem and Margaret F. McKiever. Public Health Service Publication No. 215. 1952. 213 pages; tables. 50 cents.

This publication has been prepared to meet requests for current information on small plant health and medical programs and is designed for employers who wish to establish in-plant health programs and for labor, professional, and other groups that have a special interest in employee health.

The report is concerned primarily with the organization and methods of providing health services in industry by physicians and nurses. It does not cover the technical phases of industrial hygiene engineering and chemistry or the clinical aspects of occupational medicine.

There are three major sections, the first of which, "Employee Health in Relation to Industrial Expansion," describes the need for employee health programs and the trends in the development of major types of health programs. It gives current data on personnel and facilities serving the employees in establishments of various sizes in the United States as a whole, and in selected States and cities.

Section II, "Type and Extent of Small Plant Health and Medical Programs," is concerned with the development of small plant health programs and the costs and accomplishments of such programs. A description of six cooperative programs, four communitywide projects developed under a variety of sponsorships, and four individual small plant programs is contained in the third section. Appendixes contain detailed information that may be of assistance to those responsible for the development and direction of small plant programs. References to general information in the field are also given.

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**Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication (including its Public Health Service publication number). Single copies of most Public Health Service publications can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.**

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